McMicken Dam FRZR
FCD 2002C011

Design Hydrology Draft Report

January 2004

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Memo

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To:	File Phoenix	From:	Mike Gerlach, P.E. Phoenix
File:	82000257	Date:	19 December 2003

Reference: Hydrology for the McMicken Dam FRZR Project

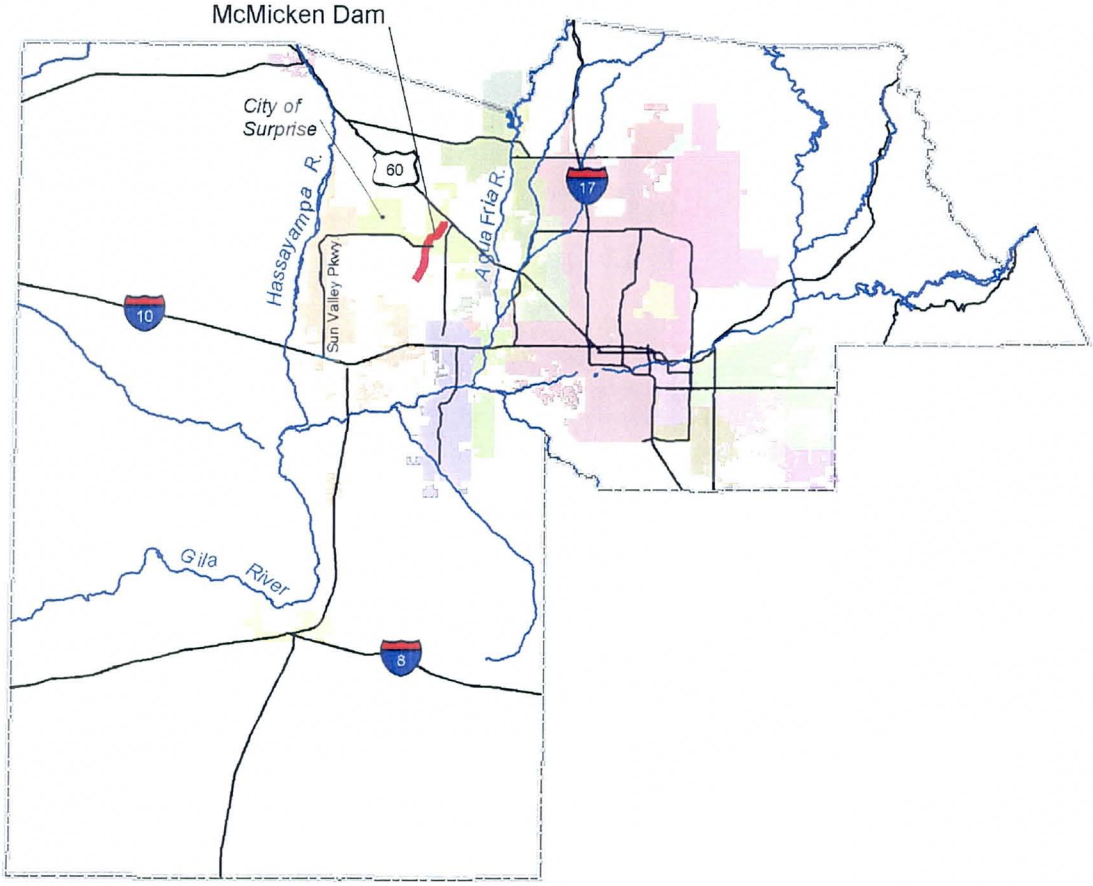
INTRODUCTION

McMicken Dam is a homogeneous earthen embankment approximately 10 miles in length that is operated and maintained by the Flood Control District of Maricopa County. The dam is located in the northwest portion of the Phoenix Metropolitan area as shown in Figure 1. The dam was designed by the U.S. Army Corps of Engineers (COE) and construction was completed in 1955. The purpose of the dam was to provide flood protection for Luke Air Force Base, Litchfield Park Naval Air Facility and adjacent areas. At that time, the majority of the surrounding area was farm land.

Over time, groundwater withdrawal in the area resulted in large scale consolidation of the alluvial soils in which the dam is founded. The consolidation of these soils has in turn caused the formation of earth fissures. In 1982, earth fissures were detected approximately 600 feet downstream of the dam at station 63+00 (south end). Subsequent studies identified the presence of earth fissures and/or horizontal strain conditions suitable for fissure formation extending from station 56+00 to 75+00. Currently, McMicken Dam is classified by the Arizona Department of Water Resources (ADWR) as a high hazard/intermediate dam.

In October of 2002, the Flood Control District of Maricopa County (District) authorized the McMicken Dam Fissure Risk Zone Remediation Project. (FRZR). In the initial phases of this project numerous alternatives were evaluated to mitigate the potential hazards associated with the existing earth fissures. The preferred alternative selected involves the construction of a new end of dam segment isolating the fissure risk zone from the rest of McMicken Dam and the breaching of the remnant dam section to a height required to provide the appropriate level of flood protection. The design events that will be considered for the final design are the 100-year, 6- and 24-hour storms, 500-year, 6- and 24-hour storms and the 6-hour local and 72-hour general Probable Maximum Precipitation (PMP). The purpose of this memorandum is to document the hydrologic modeling conducted in support of the final design for the FRZR project.

Figure 1
Vicinity Map



MAPPING

Numerous sources of mapping data were collected for hydrologic modeling purposes. The following is a brief description of each mapping source.

- USGS 7.5-Minute Series Quadrangle Maps – Two USGS Quadrangle Maps cover the contributing watershed.
    - White Tank Mountains: Published in 1972, photo revised in 1978, 40-foot contour interval.
    - Waddell: Published in 1972, 10-foot contour interval.

- Circa 2002 2-foot contour interval mapping of the District property limits for McMicken Dam. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

- Circa 2000 10-foot contour interval mapping prepared as part of the county wide mapping program. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

- Circa 1987 2-foot contour interval mapping prepared as part of the White Tanks/Agua Fria ADMS. Elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

EXISTING STUDIES

Existing hydrologic analyses of the McMciken Dam watershed were conducted by the U.S. Army Corps of Engineers in 1953, Sergent, Hauskins and Beckwith (SH&B) in 1983 and the Flood Control District of Maricopa County in 1987. The following is a brief summary of each of those analyses.

Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel, Design Memorandum No. 1 (COE, 1953) – The watershed area computed by the COE is 247 square miles. The watershed was delineated into two basins, subbasins A and B. Subbasin A represented the White Tank Mountain area and was estimated to be 21.7 square miles in size. Subbasin B was estimated to be 225 square miles in size. Runoff magnitudes were estimated for three flood events; the Standard Project Flood (SPF), the Spillway Design Flood (SDF) and the Maximum Probable Flood (MPF). The design rainfall event for the SPF is the Standard Project Storm (SPS). The SPS for McMicken Dam was developed from the August 26 – 29, 1951 storm in the Queen Creek area. A total rainfall depth of 8.6 inches was used which was uniformly distributed over the watershed. Rainfall losses for the SPF were estimated for each computational time step from a loss rate curve generated from an average loss rate value and a minimum loss rate value. The average loss rate values estimated for subbasins A and B are 0.20 and 0.30 inches/hour, respectively. The minimum loss rate values estimated for subbasins A and B are 0.15 and 0.20 inches/hour, respectively. A unit hydrograph for each subbasin was developed from

a single S-graph. The S-graph is a composite of S-graphs computed for the Blue River near Clifton, AZ; Temecula Creek at Pauba Canyon, CA; Murrieta Creek at Temecula, CA and Santa Margarita River near Fallbrook, CA.

The only difference in the SDF from the SPF is a change in the loss rate curve. For the SDF, the loss rate curve more closely resembles a constant loss rate based on the minimum values.

For the MPF, the design rainfall event is based on the maximum possible storm developed for Alamo Dam on the Bill Williams River. Rainfall losses were estimated assuming a constant loss rate equal to the minimum loss rate value for each subbasin. The resulting runoff magnitudes for each flood event are listed in Table 1.

Table 1
Runoff magnitudes for McMicken Dam estimated by the COE

Flood	Peak Inflow		Peak Outflow
Event	cfs	acre-feet	cfs
SPF	35,000	32,800	4,450
SDF	52,000	44,000	22,000
MPF	120,000	---	---

Surface Water Hydrology Report, McMicken Dam Restoration Study, Maricopa County, Arizona (SH&B, 1983) – The watershed area computed by SHB is 247 square miles. The watershed was subdivided into eight subbasins. The inflow hydrograph to the dam is generated from the Probable Maximum Precipitation (PMP) as determined from the procedures presented in *Hydrometeorological Report No. 49* (Hansen and Others, 1984). The resulting PMP for the 72-hour general storm was estimated to be 15.0 inches. Rainfall losses were estimated using the Initial Loss Plus Uniform Loss rate method. For all subbasins an initial loss and uniform loss rate was set to 0.95 inches and 0.15 inches/hour, respectively. The Kinematic Wave method was used to transform rainfall excess to a runoff hydrograph. Channel routing was accomplished using the Kinematic Wave channel routing method. The resulting inflow to McMicken Dam is 155,800 cfs

A Hydrologic Analysis of the McMicken Dam Watershed (Rumann & Sutko, 1987) – The watershed area computed by Rumann & Sutko is 247 square miles. The watershed was subdivided into 44 subbasins. The inflow hydrograph to the dam is generated from the PMP as determined from the procedures presented in *Hydrometeorological Report No. 49* (Hansen and Others, 1984). The resulting PMP for the 72-hour general storm was estimated to be 15.7 inches. Rainfall losses were estimated using the Uniform Loss Plus Constant Loss Rate Method with a uniform loss of 0.95 inches and a constant loss of 0.15 inches/hour for all subbasins. Rainfall excess was transformed to runoff hydrographs using an unit hydrograph for the mountainous subbasins and the Kinematic Wave method for all other subbasins. Channel routing was accomplished using the Kinematic Wave and Muskingum

channel routing methods. Potential attenuation of peak flows at the Central Arizona Project canal crossings as well as several crossings of State Route 79 and U.S. 60 were modeled using the Modified Puls storage routing option. The resulting inflow to McMicken Dam is 114,850 cfs.

Currently, hydrology for McMicken dam is being prepared by Entellus as part of the Wittmann Area Drainage Master Plan Update. Storm events being analyzed as part of that study are the 100-year, 200-year, 500-year and the PMP. The anticipated completion date for this study is sometime after submittal of the 30 percent plans for the FRZR project.

HYDROLOGY

General

The McMicken Dam watershed is approximately 250 square miles in size and is composed of two distinct physiographic regions. The majority of the watershed can be characterized as an undeveloped desert rangeland. The extreme upper regions of the watershed lie within the steep, rugged terrain of the Hieroglyphic and Wickenburg Mountains as can be seen in Figure 2. Elevations in this region range from approximately 2,500 feet to over 4,000 feet. Runoff from the mountain slopes is concentrated in a dendritic network of relatively steep, well defined channels. Downstream of the mountainous region, the watercourses generally loose containment as the slopes flatten out and the drainage system transitions to distributive system.

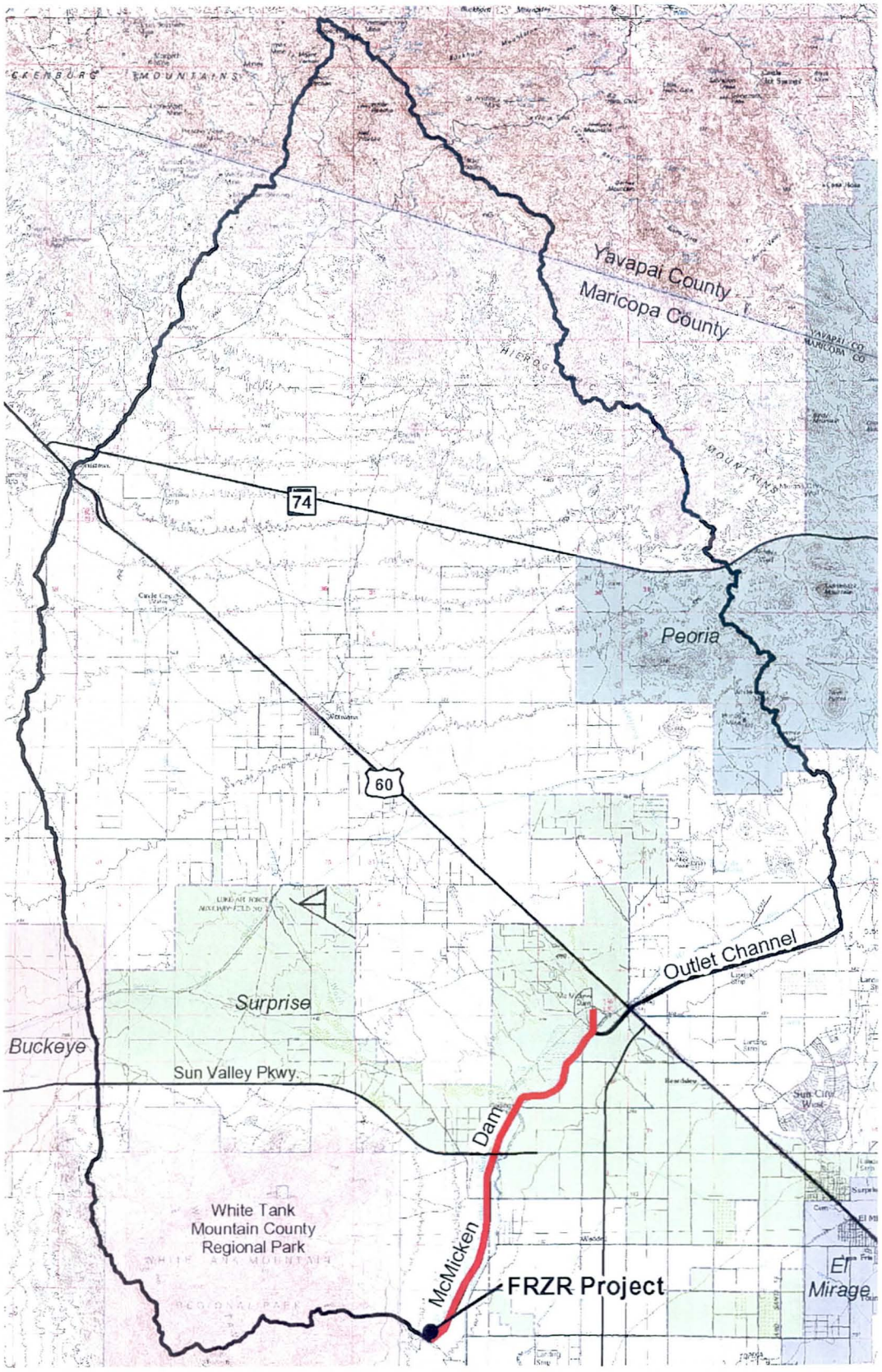
The second physiographic region lies in the southwestern portion of the watershed. This area comprises approximately 23 square miles, the majority of which lies within the limits of the White Tank Mountain County Regional Park. This region is dominated by the steep, rugged terrain of the White Tank Mountains. Runoff from the mountains flows from the west to the east in steep narrow canyons. Elevations in this area range from 1,600 feet to over 4,000 feet. Near the park boundary, the terrain changes abruptly to a relatively steep piedmont terrace with a distributary network of channels. Elevations in this area range from approximately 1,350 feet at the dam to 1,600 feet. The FRZR section of McMicken Dam lies within this second physiographic region and is shown in relation to the watershed in Figure 2.

The drainage area contributing to the FRZR project is a function of the design event. This is due to the distributive nature of the drainage network on the piedmont and the limited capacity of the individual watercourses. For the 100- and 500-year events, the numerous watercourses have sufficient capacity to convey the resulting runoff without crossing basin divides. Therefore, the FRZR watershed area can be determined with a relatively high degree of confidence from the available topographic maps and this area is approximately 0.4 square miles in size. For the PMF, the volume of runoff generated greatly exceeds the capacity of the individual watercourses essentially inundating the entire piedmont surface. Thus, delineation of

discrete drainage areas based on topography alone is not applicable. However, the potential contributing drainage area can be estimated based on an inspection of the available topographic mapping, current aerial photography and from field evidence of the surficial conditions of the area. Based on this data, the contributing drainage area is approximately 10 square miles.

Hydrologic analyses prepared as part of the FRZR project are conducted in accordance with the methodologies presented in the *Flood Control District of Maricopa County Drainage Design Manual, Volume 1, Hydrology* 1995, herein referred to as the Hydrology Manual. Two different modeling tools are used to estimate the magnitude of runoff from the FRZR watershed. For the 100- and 500-year storm events the magnitude of runoff is estimated using the COE HEC-1 computer program, version 4.1. For the PMF, runoff from the mountainous portion of the contributing watershed is modeled using HEC-1. The resulting runoff hydrographs are then input to the FLO-2D computer program which is used to model flow on the piedmont. FLO-2D is a volume conservation model that routes flow across a surface in two dimensions. FLO-2D is considered to be an appropriate model for routing shallow unconfined flow across a mildly sloping surface such as the conditions anticipated to occur during the PMF.

Figure 2
McMicken Dam and outlet channel watershed map



Hydrologic Parameters

Watershed Delineation

As stated previously, the extent of the FRZR watershed is a function of the design event. For the 100- and 500-year events, the watershed consists of one small basin approximately 0.4 square miles in size. The delineation of this basin, identified on Plate 1 as MD-1, is performed using both the circa 2002 and 1987 topographic mapping sources.

For the PMF, the watershed limits were estimated using the available topographic data, current aerial photography and from a visual inspection of the surfical conditions present on the piedmont. Based on that information, the watershed area was found to extend into portions of the White Tank Mountains. Delineation of the mountainous portion of the watershed was performed using USGS 7.5 Minute Series Quadrangle Mapping. Three subbasins were delineated in that area and those subbasins are identified on Plate 1 as MD-2A, MD-2B and 1. Subbasin 1 defines the upper reaches of Waterfall Wash which does not flow into McMicken Dam. This area is included because Waterfall Wash does not have sufficient capacity to convey the PMF flows. The limits of this subbasin were approximated from a watershed map for the Loop 303 Corridor/White Tanks ADMSU.

The topographic data used to represent the piedmont surface as input to FLO-2D is a mosaic of the circa 2002 2-foot contour interval mapping and the circa 2000 10-foot contour interval mapping. The combined surface was provided by the District in ASCII grid file format at a cell size of 10-feet. That surface was then transformed to a surface with a cell size of 100 feet which is the cell size selected for the FLO-2D simulation. The transformation process was accomplished using the interpolation routines implemented in the GDS module of FLO-2D. The resulting surface contains 14,225 grid elements.

Rainfall Statistics

Rainfall statistics for the FRZR watershed for the 100- and 500-year return periods are derived from the isopluvial maps provided in the Hydrology Manual. The statistics from those maps are analyzed to develop the rainfall depth-duration-frequency table using the PREFRE computer program. The results of that analysis are shown in Table 2. The rainfall depths shown in Table 2 are for a point in the watershed and must be converted to areally averaged depths representing the equivalent uniform rainfall depth over the entire watershed. This is accomplished for both the 6- and 24-hour storms using depth-area reduction factors specified in the Hydrology Manual.

Rainfall distributions for the 100- and 500-year, 6- and 24-hour storms are specified in the Hydrology Manual. The rainfall distribution to be used for the 24-hour storm is the SCS Type II. For the 6-hour storm, the rainfall distribution consists of five dimensionless storm patterns that are a function of watershed area. These patterns were derived from the 19 August 1954 storm over the Queen Creek area.

Table 2
Depth duration frequency table

** PREFRE OUTPUT DATA **

Revised June 1988 to update computation of short-duration values
Precipitation frequency values for McMicken Dam, Arizona

Primary Zone Number= 7
Short-Duration Zone Number= 8

POINT VALUES
RETURN PERIOD

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-Yr	500-Yr
5-MIN	0.37	0.46	0.52	0.61	0.69	0.76	0.92
10-MIN	0.55	0.69	0.80	0.94	1.05	1.16	1.42
15-MIN	0.67	0.87	1.00	1.19	1.34	1.49	1.83
30-MIN	0.89	1.16	1.35	1.61	1.82	2.02	2.49
1-HR	1.08	1.43	1.67	2.00	2.27	2.52	3.12
2-HR	1.17	1.57	1.84	2.22	2.51	2.80	3.48
3-HR	1.23	1.66	1.95	2.36	2.67	2.99	3.71
6-HR	1.34	1.83	2.17	2.63	2.98	3.34	4.16
12-HR	1.44	2.02	2.40	2.93	3.34	3.74	4.68
24-HR	1.55	2.20	2.63	3.23	3.69	4.15	5.21

NOTE: If your site is in Arizona or W. New Mexico, please consult the following paper for revised depth-area values: *Depth Area Ratios in the Semi-Arid Southwest United States,* NOAA Technical Memorandum NWS HYDRO-40, Zehr and Myers, August

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For many hydrologic purposes, precipitation falling as rain must be treated differently than that falling as snow. Please refer to the atlas volume for the state of interest for seasonal adjustments.

Prepared DEC 11, 2002

INPUT DATA

Project Name= McMicken Dam, Arizona,,
Zone= 7 Short-Duration Zone= 8

Latitude = 0.00 Longitude = 100.00 Elevation = 0

2-YR, 6-HR PCPN = 1.34 100-YR, 6-HR PCPN = 3.34
2-YR, 24-HR PCPN = 1.55 100-YR, 24-HR PCPN= 4.15

**** END OF RUN ****

The PMP for the FRZR watershed is estimated using the procedures presented in HMR-49. The drainage area used for the estimation of both the 6-hour local storm and the 72-hour general storm is 10 square miles. Worksheets for the PMP estimation are provided in Appendix A. The 6-hour local storm and 72-hour general storm PMP for the FRZR watershed are 12.7 and 17.9 inches, respectively. For the 6-hour local storm, the time distribution of the PMP is taken from Table 7 of *HMR 5* (Hansen and others, 1984) and is shown in 15-minute intervals in Table 3. The time distribution for the 72-hour general storm PMP is taken from Figure 7-3(b) of HMR 36 (U.S. Weather Bureau, 1961) and is shown at 6-hour intervals in Table 4. Also shown in Tables 3 and 4 are the incremental rainfall intensities. For the 6-hour storm, the intensity for the 15 minutes of maximum rainfall is 24.8 inches/hour. For the 72-hour storm, the intensity for the 6-hours of maximum rainfall is 1.6 inches/hour.

Table 3
Time distribution of rainfall for the 6-hour local storm PMP

Time Hours	Rainfall Depth Incremental inches	Rainfall Depth Cumulative inches	Incremental Rainfall Intensity inches/hr
0.00	0.00	0.00	0.0
0.25	0.11	0.11	0.4
0.50	0.11	0.22	0.4
0.75	0.11	0.33	0.4
1.00	0.11	0.44	0.4
1.25	0.18	0.62	0.7
1.50	0.18	0.80	0.7
1.75	0.18	0.98	0.7
2.00	0.18	1.15	0.7
2.25	6.21	7.37	24.8
2.50	1.77	9.14	7.1
2.75	0.87	10.00	3.5
3.00	0.58	10.58	2.3
3.25	0.35	10.93	1.4
3.50	0.35	11.28	1.4
3.75	0.35	11.63	1.4
4.00	0.35	11.97	1.4
4.25	0.11	12.08	0.4
4.50	0.11	12.19	0.4
4.75	0.11	12.30	0.4
5.00	0.11	12.41	0.4
5.25	0.06	12.47	0.2
5.50	0.06	12.53	0.2
5.75	0.06	12.59	0.2
6.00	0.06	12.65	0.2

Table 4
Time distribution of rainfall for the 72-hour general storm PMP

Time Hours	Rainfall Depth Incremental inches	Rainfall Depth Cumulative inches	Incremental Rainfall Intensity inches/hr
0	0.00	0.00	0.0
6	0.15	0.15	0.0
12	0.20	0.35	0.0
18	0.48	0.83	0.1
24	0.65	1.48	0.1
30	0.90	2.37	0.1
36	2.37	4.74	0.4
42	9.87	14.61	1.6
48	1.37	15.98	0.2
54	0.70	16.68	0.1
60	0.65	17.33	0.1
66	0.37	17.70	0.1
72	0.22	17.92	0.0

Rainfall Losses

Rainfall losses are estimated for existing conditions only. According to the Maricopa Association of Governments General Plan, the areas outside of the White Tank Mountain County Regional Park will consist of low density residential development. Currently, Maricopa County requires all future development to retain the 100-year, 2-hour runoff. Therefore, it is assumed that the future condition runoff will be equal to or less than the runoff for existing conditions.

Rainfall losses for the watershed are estimated using the Green and Ampt infiltration equation as implemented in the HEC-1 and FLO-2D computer programs. The variable XKSAT (hydraulic conductivity at natural saturation) is estimated by evaluating natural condition soil properties and textures as they occur on the watershed and assigning values to those soils using the procedures and data in the Hydrology Manual. Information on the soil characteristics is obtained from the *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona* (NRCS, 1986) and the *Soil Survey of Maricopa County, Arizona, Central Part* (NRCS, 1977). According to those soil surveys, there are two basic soil textures present in the watershed. In the upper portion of the watershed, within the park boundary, the soil texture can be generally characterized as a very gravelly loam with areas of rock outcrop. In the lower portion of the watershed, the soil texture can be generally characterized as a sandy clay loam. Soil map units as they occur in the watershed are shown in Plate 2. Values of XKSAT for each soil map unit present within the watershed are listed in Table 5.

Effective imperviousness, RTIMP, is attributed to rock outcroppings that occur within the watershed. Values for RTIMP for each soil map unit are obtained from the Hydrology Manual. Values of RTIMP for each soil map unit present within the watershed are listed in Table 5.

For each subbasin and grid element, an average value for XKSAT and RTIMP is computed. Average values of XKSAT and RTIMP for each HEC-1 subbasin are listed in Table 6. Calculations of the subbasin average values for XKSAT and RTIMP are provided in Appendix B as Table B-1. Average values of XKSAT and RTIMP for each grid element are provided digitally on CD as Appendix D.

Green and Ampt infiltration equation variables PSIF (wetting front capillary suction) and DTHETA (antecedent volumetric soil moisture deficit) are functions of soil texture, and therefore, XKSAT. The variable DTHETA is additionally related to the moisture condition of the soil and is categorized as either dry, normal, or saturated. For this analysis, dry DTHETA is considered typical for both the present conditions and future conditions. Values of PSIF and DTHETA are determined based on the log averaged XKSAT value for each HEC-1 subbasin and each grid element of the FLO-2D surface using Figure 4.3 of the Hydrology Manual. Values of PSIF and DTHETA for each subbasin are listed in Table 6. Values of PSIF and DTHETA for each grid element are provided digitally on CD as Appendix D.

Surface retention, IA, is an estimate of the initial surface storage that occurs during a storm event and is a function of the terrain and land use conditions. Recommended values of IA for various terrain and land use conditions present in Maricopa County are provided in Table 4.1 of the Hydrology Manual. For the mountainous portions of the watershed a value for IA of 0.25 was selected. For the piedmont, a value of 0.15 was selected. Values of IA for each subbasin are listed in Table 6. Values of IA for each grid element are provided digitally on CD as Appendix D.

It is known that hydraulic conductivity can be affected by vegetation. Vegetation within the watershed varies significantly. Most of the vegetation is concentrated along the watercourses. On the mountain slopes and on the piedmont surface, vegetation cover is relatively sparse. For this analysis the vegetation cover density is assumed to be 10 percent for the entire watershed. For this cover density, there is no adjustment to XKSAT.

Table 5
Summary of XKSAT and RTIMP values for each soil map unit within the watershed

Soil Map Unit	XKSAT inches/hour	RTIMP %
10	0.94	0
48	0.06	0
100	0.40	20
AGC	0.40	0
AHB	0.38	0
AkB	0.27	0
CO	0.29	20
EPD	0.12	0
RS	0.40	65
TB	0.40	0
Vr	0.63	0

Table 6
Summary of Green and Ampt rainfall loss parameters for each HEC-1 subbasin

Subbasin ID	Drainage Area sq. miles	IA inches	DTHETA	PSIF inches	XKSAT in/hr	RTIMP %
1*	1.940	0.20	0.35	4.00	0.52	10
MD-1	0.377	0.15	0.38	5.60	0.18	0
MD-2A	3.593	0.25	0.35	3.95	0.40	20
MD-2B	0.866	0.25	0.35	4.10	0.38	19

Note
*: Rainfall loss parameters for subbasin 1 are taken directly from the HEC-1 model for the Loop 303/White Tanks ADMPU

Unit Hydrograph

For the HEC-1 subbasins, unit hydrographs are developed from S-graphs provided in the Hydrology Manual. Two S-graphs are used for this analysis. The Desert/Rangeland S-graph is used for subbasin MD-1 and the Phoenix Mountain S-graph is used for subbasins MD-2A and MD-2B. Application of the S-graph requires the estimation of the basin lag. The basin lag is a function of the flow path length, the flow path length from the point opposite to the basin centroid, the slope of the flow path and a coefficient representing the hydraulic efficiency, K_n, of the watershed. The flow path for each subbasin is shown on Plate 1. The flow path length and slope for each subbasin is estimated using one or all of the topographic mapping sources discuss previously. Guidance for selection of the value for K_n is provided in the

Hydrology Manual. The basin lag for each subbasin along with the physical parameters are listed in Table 7.

Table 7
S-Graph parameters for each HEC-1 subbasin

Subbasin ID	Basin Area sq. miles	Flow Path Length miles	Flow Path Lca miles	Flow Path Slope ft/mi	K_n	Lag hours
1*	1.940	3.40	1.36	505.5	0.05	0.65
MD-1	0.377	1.26	0.33	86.1	0.03	0.22
MD-2A	3.593	4.59	2.26	417.9	0.05	0.92
MD-2B	0.866	2.44	1.23	581.1	0.05	0.54

Note
*: Rainfall loss parameters for subbasin 1 are taken directly from the HEC-1 model for the Loop 303/White Tanks ADMPU

Two Dimensional Model

In the FLO-2D model, rainfall excess is routed using a central, finite difference solution of the dynamic wave momentum equation and conservation of volume. Progression of the floodwave is controlled by topography and resistance to flow.

Flow resistance factors are represented as Manning's roughness coefficients. Roughness coefficients for each grid element are estimated based on the general physical characteristics of the piedmont surface. The primary physical characteristics considered are the bed/ground surface material and obstructions to flow, particularly obstructions due to vegetation. Based on field reconnaissance trips and inspection of aerial photography, a base roughness coefficient for all grid elements of 0.04 is selected. For the grid elements representing the watercourses, the base roughness coefficient was adjusted accordingly to reflect those specific physical conditions. In general, the watercourses in the upper portion of the piedmont are deeply incised with a bed material consisting of coarse gravel with a significant percentage of cobbles and small boulders. The channel banks are lined with moderately dense vegetation consisting primarily of small trees and shrubs. For these conditions, a roughness coefficient of 0.06 is selected. In the lower portion of the piedmont, the general roughness characteristics diminish somewhat. The bed material consists of primarily a matrix of sand and fine gravel. The channel banks are also lined with moderately dense vegetation that, in some areas, has established itself in the bed of the channels. For these conditions, a roughness coefficient of 0.05 is selected. The roughness coefficient for each grid element is shown graphically in Plate 3.

For many grid elements, it is anticipated that very shallow flow conditions will exist. For such conditions, a different order of magnitude of roughness coefficients than for normal flow conditions must be used. In FLO-2D, this is handled by specifying a shallow flow n-value. The shallow flow n-value is applied to all grid elements for

depths less than 0.2 feet. Between 0.2 and 0.5 feet, the shallow flow n-value is reduced by 50 percent. For depths greater than 0.5 feet the roughness coefficient specified for each grid element is used. For this analysis, a shallow flow n-value of 0.1 was selected. This value was selected to be representative of the conditions for the grid elements other than those defining the watercourses. Outside of the watercourses, the surface is generally bare ground. The surface material can be classified as very fine grained with pockets of areas that can be characterized as desert pavement. Vegetation in these areas is considered to be sparse.

The other factor controlling the progression of the floodwave is topography. Elevations used in the FLO-2D model were generated from the available mapping data as discussed previously. The slope of the surface is relatively steep. The typical slope is between one and two percent. For these slopes, it is likely that supercritical flow would be calculated given the assigned roughness coefficients. However, supercritical flow conditions rarely exist on steep alluvial surfaces due to the high concentrations of sediment being transported. Sediment transport is the primary mechanism by which steep alluvial watercourses dissipate energy. This physical process is modeled in FLO-2D by the specification of a limiting Froude Number. Specification of a limiting Froude Number causes the model to increase the roughness coefficient for any grid element with a computed Froude Number greater than the limiting value. For this analysis, a limiting Froude Number of 0.9 is selected. This value is selected because it is believed that near critical flow conditions may exist throughout the area, particularly in the upper reaches of the piedmont.

Results

Peak discharges and runoff volumes are computed for the 100- and 500-year, 6- and 24-hour storms for subbasin MD-1 only. Those results are listed in Table 8. As can be seen from this table, the 6-hour storm is the critical flood producing storm for both the 100- and 500-year recurrence intervals. Unit discharges for the 100- and 500-year, 6-hour storm are 2,760 and 3,580 cfs/sq. mile, respectively.

Table 8
100- and 500-year runoff magnitudes for subbasin MD-1

Recurrence	Peak Discharge		Runoff Volume	
Interval	6-Hour	24-Hour	6-Hour	24-Hour
	cfs	cfs	acre-feet	acre-feet
100	1,040	790	36	28
500	1,350	1,030	50	39

Inflow to the FRZR project for the PMF is estimated for both the 0.4 square mile drainage area represented by subbasin MD-1 and for the 10 square mile contributing drainage area. The PMF is estimated for the 0.4 square mile area primarily as a means of determining the additional inflow that could be expected due to the nature of flooding on the piedmont during the PMF. The runoff magnitudes for the 0.4

square mile area were computed for both the 6- and 72-hour PMP. Those results are listed in Table 9. As can be seen from this table, the 6-hour PMP is the critical flood producing storm. Based on these results, only the 6-hour PMP was considered for the 10 square mile contributing area. This is a reasonable assumption given the size of the contributing area in regard to the differences in rainfall between the 6- and 72-hour PMP.

Table 9
Runoff magnitudes for subbasin MD-1 for the PMF

PMP	Peak Discharge cfs	Runoff Volume acre-feet
6-hour	4,480	200
72-hour	340	180

For the 10 square mile drainage area, inflow to the FRZR project is estimated using a combination of the HEC-1 and FLO-2D models. First, runoff from the mountainous portion of the contributing watershed is computed using HEC-1. The resulting peak discharges and runoff volumes are listed in Table 10. The runoff hydrographs are then input to the FLO-2D model at the appropriate grid elements. The runoff hydrographs are routed across the piedmont and combined with rainfall excess produced on the piedmont surface. The resulting inundation area is shown on Plate 4. Also shown on Plate 4 are the limits of the 0.4 square mile drainage area. As can be seen on Plate 4, runoff from Waterfall Wash and the wash immediately north of the proposed dam extension enter the FRZR project area. The resulting volume of inflow to the FRZR project area during the 6-hour PMF is 300 acre-feet. Print outs of the HEC-1 input and output files are provided in Appendix C. The input and output files are also provided digitally on CD as Appendix D. FLO-2D input and output files are also included on the CD.

Table 10
Runoff magnitudes for each subbasin for the PMF

Subbasin ID	Drainage Area sq. miles	Peak Discharge 6-Hour cfs	Peak Discharge 72-Hour cfs	Runoff Volume 6-Hour acre-feet	Runoff Volume 72-Hour acre-feet
MD-1	0.377	4,480	340	200	180
MD-2A	3.593	15,180	2,880	1,900	1,720
MD-2B	0.866	5,390	710	460	420
1	1.940	10,700	1,370	970	750

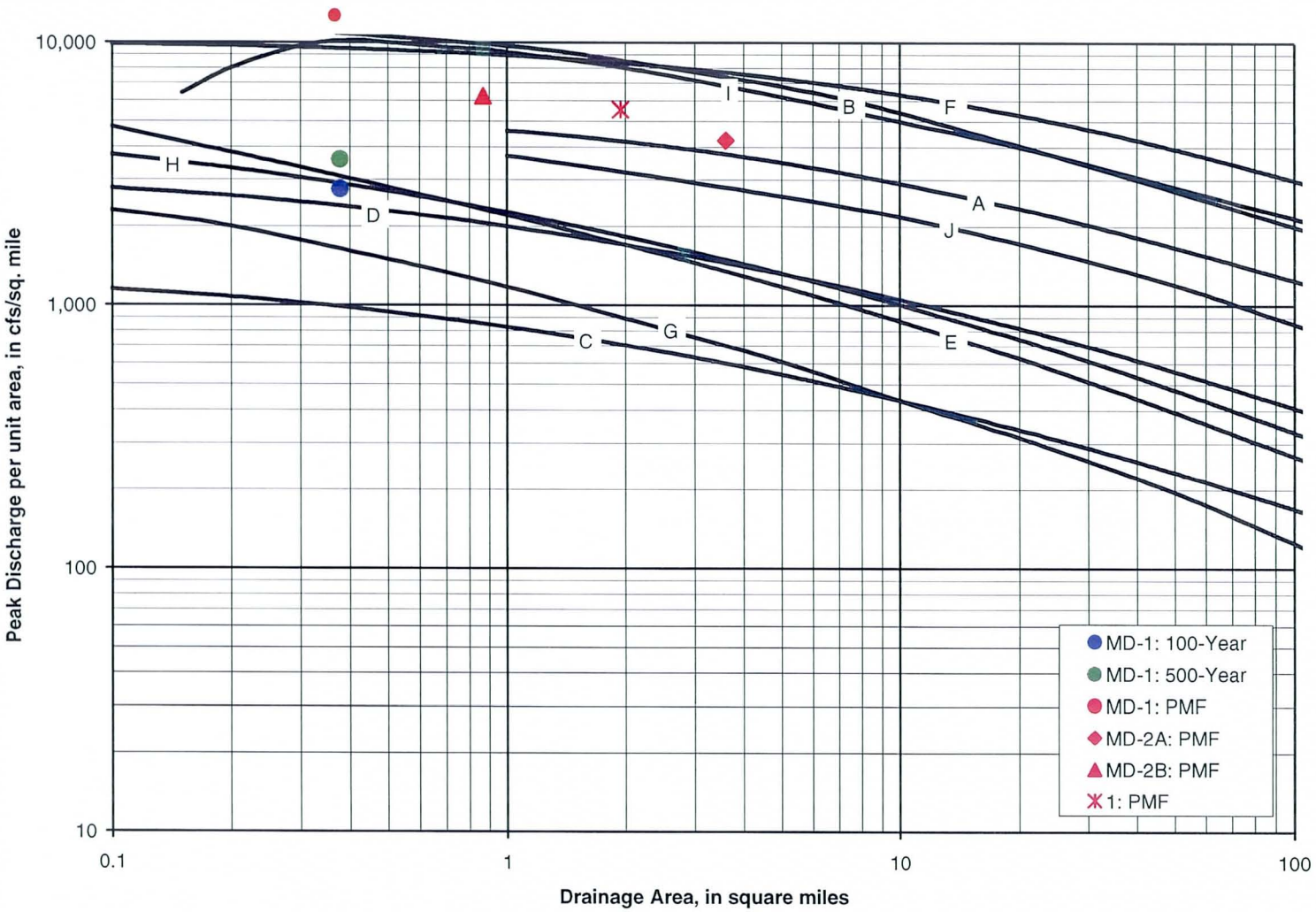
Calibration

Calibration of the HEC 1 models is not possible because of the lack of available physical data for this watershed. In lieu of calibration, indirect methods of model verification are performed and compared to the modeling results. Indirect methods used for model verification are provided in the ADWR State Standards SS2-96. Two of the methods provided in that document are applicable to the FRZR watershed. The first method is comparison of model results to regional data. The regional data consists of ten envelope curves and these curves are shown in Figure 3. Seven of these curves represent envelopes of maximum observed flood discharges (Curves A, B, D, E, F, I and J), one is a 100 year discharge envelope (Curve H), and two are 100-year discharge relations (Curves C and G). Based on this data, the results for subbasin MD-1 for both the 100- and 500-year event as well as the PMF could be considered conservative, but not unreasonable. For subbasins MD-2A, MD-2B and 1, the results for the PMF seem to fit well with the maximum observed flood discharge data.

The second indirect method is comparison of model results with USGS gage data. This method is only applicable to the 100-year model results for subbasin MD-1. USGS 100-year peak discharge estimates for gaged watershed within Arizona are shown in Figure 4. Also shown in that figure is a set of curves representing the results of a regression analysis of the USGS peak discharge estimates. As can be seen from Figure 4, the 100-year peak discharge for subbasin MD-1 fits within the tolerances of the regression analysis of the USGS 100-year peak discharge estimates.

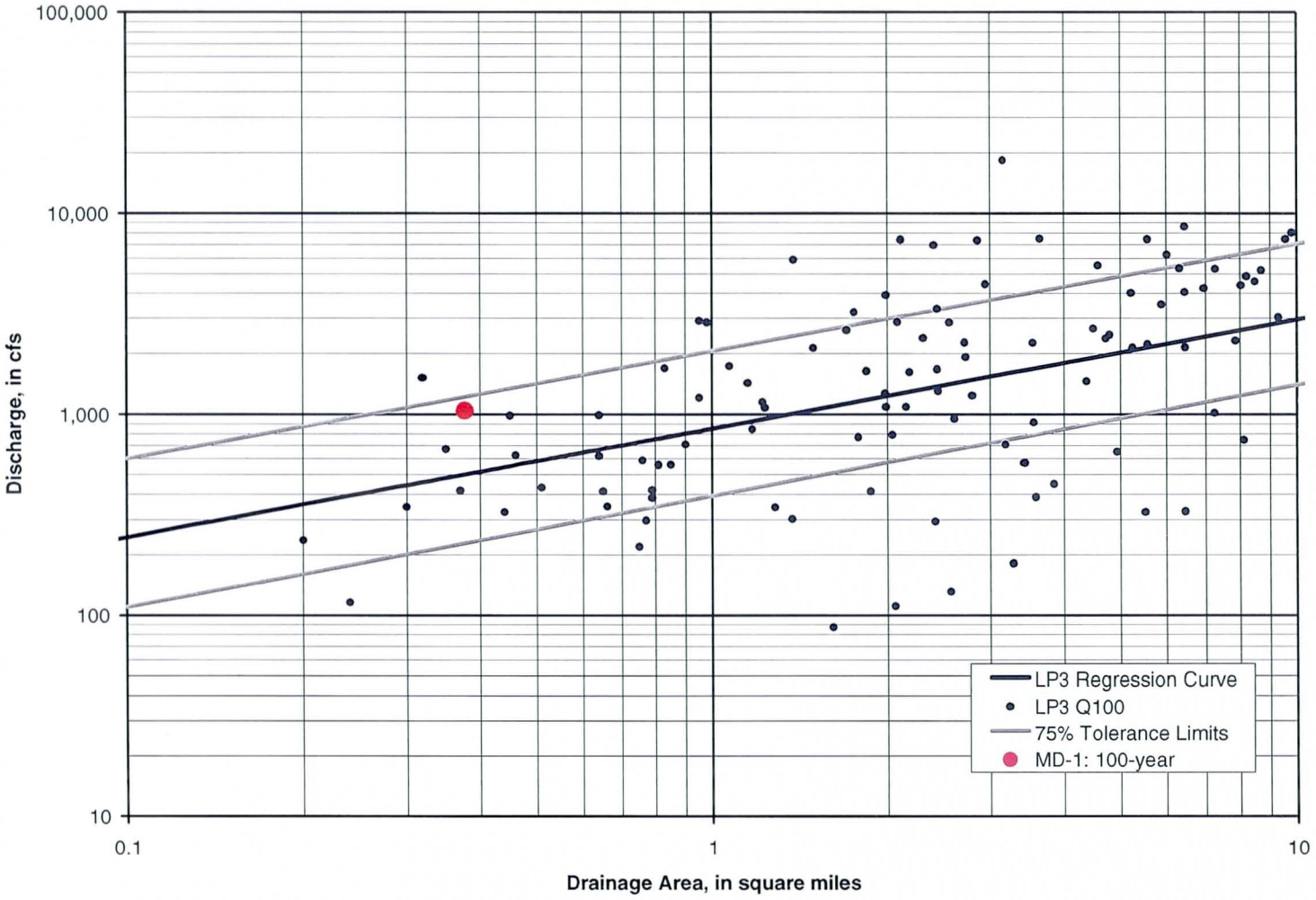
Stantec

Figure 3
Comparison of model results with regional data



Stantec

Figure 4
Comparison with USGS gage data



APPENDIX A

PMP WORKSHEETS

Local Storm PMP Worksheet

Drainage Basin	McMicken Dam - station 42+00 - 75+00
Drainage Area	10 sq, miles
Latitude	33° 34'
Longitude	112° 31'

1.	Average 1-hr, 1-sq. mile PMP[a]	11.5 inches
2.	a. Reduction for elevations[b]	100 percent
	b. Multiply (1) by (2a)	11.5 inches
3.	Average 6/1-hr ratio[c]	1.24

		Duration, in hours									
		1/4	1/2	3/4	1	2	3	4	5	6	
4.	Duration Variation for 6/1-hr ratio of (3)[d]	74	89	95	100	112	118	121	124	125	percent
5.	1-sq. mile PMP for indicated durations	8.5	10.2	10.9	11.5	12.9	13.6	13.9	14.3	14.4	inches
6.	Areal Reduction[e]	73	78	81	82	84	85	86	87	88	percent
7.	Areally Reduced PMP	6.2	8.0	8.8	9.4	10.8	11.5	12.0	12.4	12.7	inches
8.	Incremental PMP				9.4	1.4	0.7	0.4	0.4	0.2	inches
		6.2	1.8	0.9	0.6						inches
9.	Time Sequence for										
	Hourly Increments[f]				0.4	0.7	**9.4**	1.4	0.4	0.2	
	15-min Increments[g]				**6.2**	**1.8**	**0.9**	**0.6**			

Notes

a. From Figure 4.5
b. No adjustment for elevations up to 5,000 feet; 5% decrease per 1,000 feet above 5,000 feet
c. From Figure 4.7
d. From Table 4.4
e. From Figure 4.9
f. Per Table 4.7
g. Per Table 4.8

General Storm PMP Worksheet

Drainage Basin	McMicken Dam - station 42+00 - 75+00
Drainage Area	10 sq, miles
Latitude	33° 34'
Longitude	112° 31'

A. Convergence PMP

1.	Drainage Area Value[a]	13.9 inches
2.	Reduction for Barrier Elevation[b]	87 percent
3.	Barrier Elevation Reduced PMP	12.1 inches

		Duration, in hours						
		6	12	18	24	48	72	
4.	Duration Variation[c]	75	89	96	100	112	116	
5.	Convergence PMP	9.1	10.8	11.6	12.1	13.5	14.0	inches
6.	Incremental 10 sq. mile PMP	9.1	1.7	0.8	0.5	1.5	0.5	inches
7.	Areal Reduction[d]	99	100	100	100	100	100	percent
8.	Areally Reduced PMP	9.0	1.7	0.8	0.5	1.5	0.5	inches
9.	Drainage Average PMP	9.0	10.7	11.5	12.0	13.5	13.9	inches

B. Orographic PMP

1.	Drainage Area Orographic PMP[e]	2.5 inches
2.	Areal Reduction[f]	100 percent
3.	Adjustment for Month[g]	100 percent
4.	Areally and Seasonally Adjusted PMP	2.5 inches

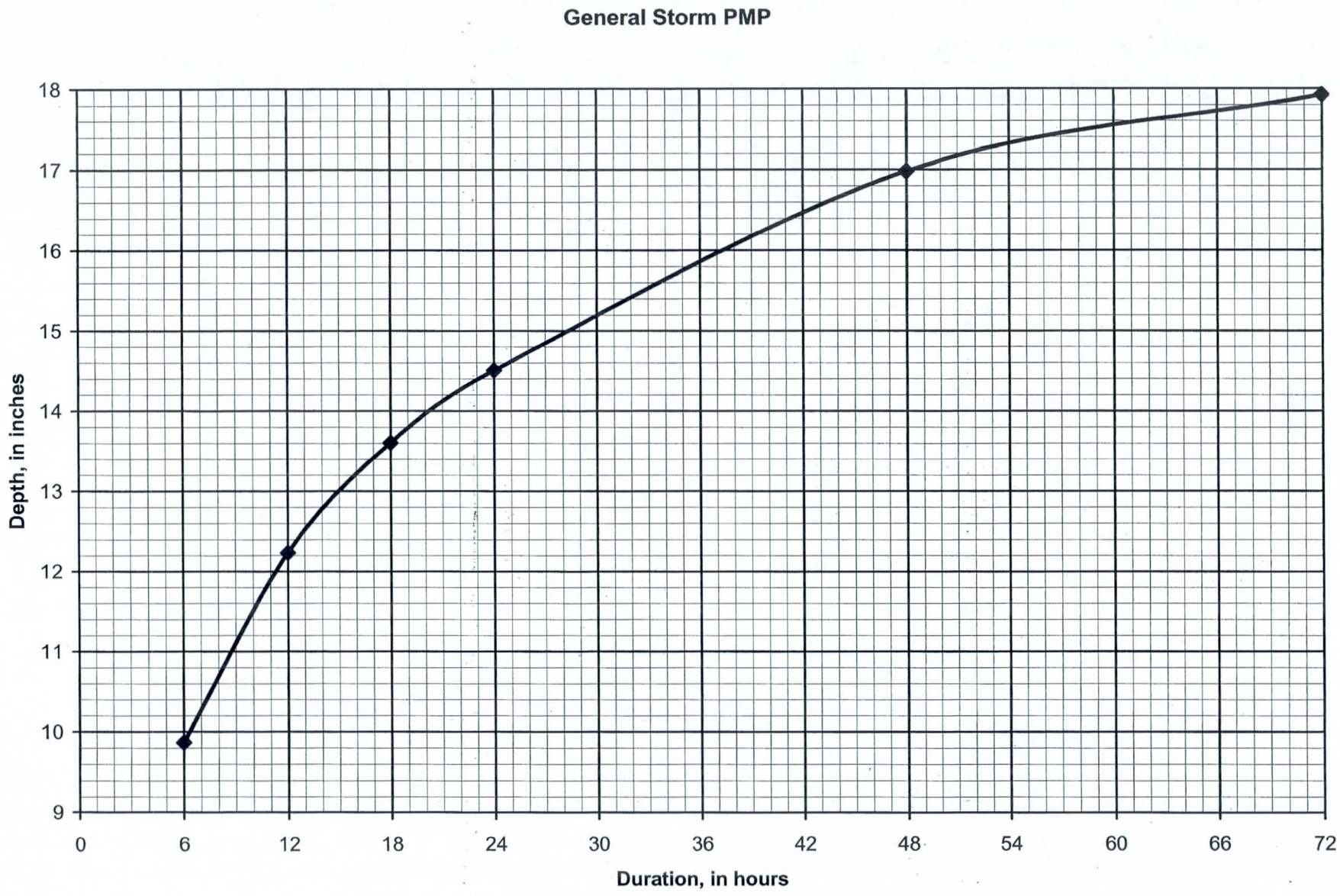
		Duration, in hours					
		6	12	18	24	48	72
5.	Durational Variation	35.5	62.5	83.5	100	141	159.5
6.	Orographic PMP	0.9	1.6	2.1	2.5	3.5	4.0

C. Total PMP

1.	Drainage Area Orographic PMP	9.9	12.2	13.6	14.5	17.0	17.9	inches

Notes

a. From one of Figures 2.5 to 2.16
b. From Figure 2.18
c. From one of Figures 2.25 - 2.27 and Table 2.7
d. Figures 2.28 and 2.29
e. Figures 3.11a - 3.11d
f. From Figure 3.20
g. From one of Figures 3.12 - 3.17


General Storm PMP
Depth, in inches
18
17
16
15
14
13
12
11
10
9
0
6
12
18
24
30
36
42
48
54
60
66
72
Duration, in hours

APPENDIX B

RAINAFALL LOSS PARAMETER SUPPORTING CALCULATIONS

Table B-1
Rainfall loss calculations

MD-1

Soil Class ...	AHC	AkB	EPD	Vr
Sub-Area (acres) ...	18.1	83.1	136.7	2.6
XKSAT (bare ground) ...	0.38	0.27	0.12	0.63
RTIMP ...	0.0%	0.0%	0.0%	0.0%
IA ...	0.15	0.15	0.15	0.15

XKSAT log avg (bare ground) =	**0.18**	
PSIF =	**5.62**	
DTHETA (Dry) =	**0.38**	
RTIMP avg. =	**0.0**	**%**
IA avg. =	**0.15**	
Veg. Cover avg. =	**10**	**%**
XKSAT log avg (adjusted) =	**0.18**	

Total Sub Basin Area in sq. miles = 0.3758

MD-2A

Soil Class ...	100
Sub-Area (acres) ...	2299.5
XKSAT (bare ground) ...	0.40
RTIMP ...	20.0%
IA ...	0.25

XKSAT log avg (bare ground) =	**0.40**	
PSIF =	**3.99**	
DTHETA (Dry) =	**0.35**	
RTIMP avg. =	**20.0**	**%**
IA avg. =	**0.25**	
Veg. Cover avg. =	**10**	**%**
XKSAT log avg (adjusted) =	**0.40**	

Total Sub Basin Area in sq. miles = 3.5930

MD-2B

Soil Class ...	100	48	EPD
Sub-Area (acres) ...	538.6	15.5	0.1
XKSAT (bare ground) ...	0.40	0.06	0.12
RTIMP ...	20.0%	0.0%	0.0%
IA ...	0.25	0.25	0.15

XKSAT log avg (bare ground) =	**0.38**	
PSIF =	**4.08**	
DTHETA (Dry) =	**0.35**	
RTIMP avg. =	**19.4**	**%**
IA avg. =	**0.25**	
Veg. Cover avg. =	**10**	**%**
XKSAT log avg (adjusted) =	**0.38**	

Total Sub Basin Area in sq. miles = 0.8660

APPENDIX C

HEC-1 INPUT AND OUTPUT

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998               *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   12JAN04  TIME  13:29:20  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

                                                X     X  XXXXXXX   XXXXX           X
                                                X     X  X        X     X         XX
                                                X     X  X        X                X
                                                XXXXXXX  XXXX     X        XXXXX   X
                                                X     X  X        X                X
                                                X     X  X        X     X          X
                                                X     X  XXXXXXX   XXXXX         XXX

          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT
STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                    PAGE  1

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          1           ID   McMicken Dam FRZR Task 3
          2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
          3           ID
          4           ID   Stantec Consulting Inc.
          5           ID   Proj No. 82000257
          6           ID   File:  Pr100-6.ih1
          7           ID   Date:  11/11/03 dln
          8           ID   Rev:
          9           ID
         10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
         11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
         12           ID   reduce impacts of flooding downstream due to the drainage area no longer
         13           ID   contributing to McMicken Dam.  Severa design events are investigated for the
         14           ID   IDF.  This model is for the 100-year, 6-hour storm.
         15           ID
         16           ID   Rainfall:  100-year, 6-hour point rainfall = 3.34 inches
         17           ID   Rainfall Loses:  Green and Ampt Rainfall Losses
         18           ID   Unit Hydrograph:  Desert/Rangeland S-Graph
         19           ID
         20           IT       5                    2000
         21           IO       3
         22           IN      15
                      *
                      *DIAGRAM
                      *
         23           JD    3.34    0.01
         24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
         25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
         26           PC   0.962   0.972   0.983   0.991   1.000
         27           JD   3.318    0.50
         28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
         29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
         30           PC   0.962   0.972   0.983   0.991   1.000
                      *

         31           KK    MD-1   BASIN
         32           KM   Subbasin     MD-1
         33           KM
         34           KM      The Desert/Rangeland S-Graph is used for this basin.
         35           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
         36           KM        Lag =  13.3 min
         37           KM
         38           BA   0.377
         39           LG    0.15    0.38    5.62    0.18       0
```

```
          40          UI     193     712     895     551     286     142      75      28      24       0
          41          UI       0       0       0       0       0       0       0       0       0       0
          42          UI       0       0       0       0       0       0       0       0       0       0
                       *
          43          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    31        MD-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN  1998               *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   12JAN04  TIME  13:29:20  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


                         McMicken Dam FRZR Task 3
                         For the Flood Control District of Maricopa County, FCD 2002C011

                         Stantec Consulting Inc.
                         Proj No. 82000257
                         File:  Pr100-6.ih1
                         Date:  11/11/03 dln
                         Rev:

                         A new dam extension is to be constructed approximately at station 75+00.  The
                         remnant section of McMicken Dam is to be modified/breached as needed to
                         reduce impacts of flooding downstream due to the drainage area no longer
                         contributing to McMicken Dam.  Severa design events are investigated for the
                         IDF.  This model is for the 100-year, 6-hour storm.

                         Rainfall:  100-year, 6-hour point rainfall = 3.34 inches
                         Rainfall Loses:  Green and Ampt Rainfall Losses
                         Unit Hydrograph:  Desert/Rangeland S-Graph


  21 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

  22 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE     1    0  STARTING DATE
                      JXTIME          0  STARTING TIME

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     7    0  ENDING DATE
                      NDTIME       2235  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

  23 JD          INDEX STORM NO. 1
                       STRM       3.34  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA
```

```
 24 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 27 JD          INDEX STORM NO. 2
                      STRM        3.32  PRECIPITATION DEPTH
                      TRDA         .50  TRANSPOSITION DRAINAGE AREA

 28 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***

            **************
            *            *
 31 KK      *      MD-1  *        BASIN
            *            *
            **************
                          Subbasin     MD-1

                             The Desert/Rangeland S-Graph is used for this basin.
                               L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                               Lag =  13.3 min


              SUBBASIN RUNOFF DATA

 38 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .38  SUBBASIN AREA

 39 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .15  STARTING LOSS
                        DTH         .38  MOISTURE DEFICIT
                       PSIF        5.62  WETTING FRONT SUCTION
                      XKSAT         .18  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 32 UI          INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                    193.0     712.0     895.0     551.0     286.0     142.0      75.0      28.0      24.0
                                                                   ***

     ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     MD-1
                      TRANSPOSITION AREA       .0 SQ MI

    TOTAL RAINFALL =    3.34, TOTAL LOSS =    1.50, TOTAL EXCESS =    1.84

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                         (CFS)
+    1049.      4.08                 74.         19.          6.           3.
                      (INCHES)     1.829       1.829       1.829        1.829
                       (AC-FT)      37.         37.         37.          37.

                       CUMULATIVE AREA =     .38 SQ MI


     ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     MD-1
```

```
                    TRANSPOSITION AREA        .5 SQ MI

    TOTAL RAINFALL =    3.32, TOTAL LOSS =    1.50, TOTAL EXCESS =    1.82

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1041.      4.08                 73.         18.          6.          3.
                        (INCHES)   1.811       1.811       1.811       1.811
                         (AC-FT)    36.         36.         36.         36.

                        CUMULATIVE AREA =     .38 SQ MI

      ***             ***            ***            ***            ***


                        INTERPOLATED HYDROGRAPH AT     MD-1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1042.      4.08                 74.         18.          6.          3.
                        (INCHES)   1.813       1.813       1.813       1.813
                         (AC-FT)    36.         36.         36.         36.

                        CUMULATIVE AREA =     .38 SQ MI

1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION      FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                         MD-1       1042.   4.08         74.         18.          6.        .38


 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN  1998                *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   12JAN04  TIME  13:29:32  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT
STRUCTURE.
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          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                    PAGE  1

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          1           ID   McMicken Dam FRZR Task 3
          2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
          3           ID
          4           ID   Stantec Consulting Inc.
          5           ID   Proj No. 82000257
          6           ID   File:  Pr100-24.ih1
          7           ID   Date:  11/13/03     dln
          8           ID   Rev:
          9           ID
         10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
         11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
         12           ID   reduce impacts of flooding downstream due to the drainage area no longer
         13           ID   contributing to McMicken Dam.  Severa design events are investigated for the
         14           ID   IDF.  This model is for the 100-year, 24-hour storm.
         15           ID
         16           ID   Rainfall:  100-year, 24-hour point rainfall = 4.15 inches
         17           ID   Rainfall Losses:  Green and Ampt Rainfall Losses
         18           ID   Unit Hydrograph:  Desert/Rangeland S-Graph
         19           ID
         20           IT       5                    2000
         21           IO       3
         22           IN      15
                      *
                      *DIAGRAM
                      *
         23           JD    4.15    0.01
         24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
         25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
         26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
         27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
         28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
         29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
         30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
         31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
         32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
         33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
         34           JD   4.138     0.5
                      *

         35           KK    MD-1   BASIN
         36           KM   Subbasin     MD-1
         37           KM
         38           KM      The Desert/Rangeland S-Graph is used for this basin.
         39           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
```

```
            40          KM        Lag =  13.3 min
            41          KM
            42          BA   0.377
            43          LG    0.15    0.38    5.62    0.18       0
            44          UI     193     712     895     551     286     142      75      28      24       0
            45          UI       0       0       0       0       0       0       0       0       0       0
            46          UI       0       0       0       0       0       0       0       0       0       0
                        *
            47          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    35        MD-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ***************************************
 *                                      *                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN  1998               *                                    *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *         609 SECOND STREET           *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   12JAN04  TIME  13:29:32  *                                    *          (916) 756-1104             *
 *                                      *                                    *                                     *
 ****************************************                                    ***************************************


                        McMicken Dam FRZR Task 3
                        For the Flood Control District of Maricopa County, FCD 2002C011

                        Stantec Consulting Inc.
                        Proj No. 82000257
                        File:  Pr100-24.ih1
                        Date:  11/13/03        dln
                        Rev:

                        A new dam extension is to be constructed approximately at station 75+00.  The
                        remnant section of McMicken Dam is to be modified/breached as needed to
                        reduce impacts of flooding downstream due to the drainage area no longer
                        contributing to McMicken Dam.  Severa design events are investigated for the
                        IDF.  This model is for the 100-year, 24-hour storm.

                        Rainfall:  100-year, 24-hour point rainfall = 4.15 inches
                        Rainfall Losses:  Green and Ampt Rainfall Losses
                        Unit Hydrograph:  Desert/Rangeland S-Graph


  21 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

  22 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      7    0  ENDING DATE
                     NDTIME       2235  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

```
23 JD          INDEX STORM NO. 1
                    STRM        4.15  PRECIPITATION DEPTH
                    TRDA         .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                     .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                     .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                     .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00

34 JD          INDEX STORM NO. 2
                    STRM        4.14  PRECIPITATION DEPTH
                    TRDA         .50  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                     .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                     .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                     .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***


            **************
            *            *
35 KK       *     MD-1   *        BASIN
            *            *
```

```
**************
                    Subbasin     MD-1

                      The Desert/Rangeland S-Graph is used for this basin.
                        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                        Lag =  13.3 min


              SUBBASIN RUNOFF DATA

   42 BA          SUBBASIN CHARACTERISTICS
                        TAREA          .38  SUBBASIN AREA

   43 LG          GREEN AND AMPT LOSS RATE
                        STRTL          .15  STARTING LOSS
                          DTH          .38  MOISTURE DEFICIT
                         PSIF         5.62  WETTING FRONT SUCTION
                        XKSAT          .18  HYDRAULIC CONDUCTIVITY
                        RTIMP          .00  PERCENT IMPERVIOUS AREA

   36 UI          INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                      193.0     712.0     895.0     551.0     286.0     142.0      75.0      28.0      24.0
                                                                                  ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     MD-1
                       TRANSPOSITION AREA       .0 SQ MI

     TOTAL RAINFALL =    4.15, TOTAL LOSS =    2.76, TOTAL EXCESS =    1.39

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     789.     12.08                   56.         14.          5.          2.
                       (INCHES)     1.385       1.385       1.385       1.385
                        (AC-FT)       28.         28.         28.         28.

                       CUMULATIVE AREA =     .38 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     MD-1
                       TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    4.14, TOTAL LOSS =    2.75, TOTAL EXCESS =    1.38

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     787.     12.08                   56.         14.          5.          2.
                       (INCHES)     1.378       1.378       1.378       1.378
                        (AC-FT)       28.         28.         28.         28.

                       CUMULATIVE AREA =     .38 SQ MI

      ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT     MD-1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     787.     12.08                   56.         14.          5.          2.
                       (INCHES)     1.379       1.379       1.379       1.379
                        (AC-FT)       28.         28.         28.         28.

                       CUMULATIVE AREA =     .38 SQ MI

1
                                                   RUNOFF SUMMARY
                                             FLOW IN CUBIC FEET PER SECOND
                                          TIME IN HOURS,  AREA IN SQUARE MILES
```

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	MD-1	787.	12.08	56.	14.	5.	.38		

*** NORMAL END OF HEC-1 ***

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   12JAN04  TIME  13:29:42  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

                                                  X     X  XXXXXXX   XXXXX           X
                                                  X     X  X        X     X         XX
                                                  X     X  X        X               X
                                                  XXXXXXX  XXXX     X        XXXXX  X
                                                  X     X  X        X               X
                                                  X     X  X        X     X         X
                                                  X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT
STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                    HEC-1 INPUT                                                    PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   McMicken Dam FRZR Task 3
            2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
            3           ID
            4           ID   Stantec Consulting Inc.
            5           ID   Proj No. 82000257
            6           ID   File:  Pr500-6.ih1
            7           ID   Date:  11/11/03      dln
            8           ID   Rev:
            9           ID
           10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
           11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
           12           ID   reduce impacts of flooding downstream due to the drainage area no longer
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           15           ID
           16           ID   Rainfall:  500-year, 6-hour point rainfall = 4.16 inches
           17           ID   Rainfall Loses:  Green and Ampt Rainfall Losses
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           20           IT       5                    2000
           21           IO       3
           22           IN      15
                        *
                        *DIAGRAM
                        *
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           24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           26           PC   0.962   0.972   0.983   0.991   1.000
           27           JD   4.133    0.50
           28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           30           PC   0.962   0.972   0.983   0.991   1.000
                        *

           31           KK    MD-1   BASIN
           32           KM   Subbasin     MD-1
           33           KM
           34           KM      The Desert/Rangeland S-Graph is used for this basin.
           35           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
           36           KM        Lag =  13.3 min
           37           KM
           38           BA   0.377
           39           LG    0.15    0.38    5.62    0.18       0
```

```
            40          UI     193     712     895     551     286     142      75      28      24       0
            41          UI       0       0       0       0       0       0       0       0       0       0
            42          UI       0       0       0       0       0       0       0       0       0       0
                        *
            43          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE       (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    31         MD-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN  1998               *                                    *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                    *         609 SECOND STREET            *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   12JAN04  TIME  13:29:42  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************
```

McMicken Dam FRZR Task 3
For the Flood Control District of Maricopa County, FCD 2002C011

Stantec Consulting Inc.
Proj No. 82000257
File: Pr500-6.ih1
Date: 11/11/03 dln
Rev:

A new dam extension is to be constructed approximately at station 75+00. The remnant section of McMicken Dam is to be modified/breached as needed to reduce impacts of flooding downstream due to the drainage area no longer contributing to McMicken Dam. Severa design events are investigated for the IDF. This model is for the 500-year, 6-hour storm.

Rainfall: 500-year, 6-hour point rainfall = 4.16 inches
Rainfall Loses: Green and Ampt Rainfall Losses
Unit Hydrograph: Desert/Rangeland S-Graph

```
  21 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

  22 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE      1    0  STARTING DATE
                      JXTIME           0  STARTING TIME

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      7    0  ENDING DATE
                      NDTIME        2235  ENDING TIME
                       ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

  23 JD          INDEX STORM NO. 1
                       STRM        4.16  PRECIPITATION DEPTH
                       TRDA         .01  TRANSPOSITION DRAINAGE AREA
```

```
 24 PI            PRECIPITATION PATTERN
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                      .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                      .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00

 27 JD          INDEX STORM NO. 2
                        STRM        4.13  PRECIPITATION DEPTH
                        TRDA         .50  TRANSPOSITION DRAINAGE AREA

 28 PI            PRECIPITATION PATTERN
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                      .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                      .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***

            **************
            *            *
 31 KK      *     MD-1   *        BASIN
            *            *
            **************
                          Subbasin     MD-1

                            The Desert/Rangeland S-Graph is used for this basin.
                              L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                              Lag =  13.3 min


              SUBBASIN RUNOFF DATA

 38 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .38  SUBBASIN AREA

 39 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .15  STARTING LOSS
                        DTH         .38  MOISTURE DEFICIT
                       PSIF        5.62  WETTING FRONT SUCTION
                      XKSAT         .18  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 32 UI          INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                    193.0     712.0     895.0     551.0     286.0     142.0      75.0      28.0      24.0

                                                                  ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION     MD-1
                      TRANSPOSITION AREA       .0 SQ MI

    TOTAL RAINFALL =    4.16, TOTAL LOSS =    1.63, TOTAL EXCESS =    2.53

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1356.      4.08                102.         25.          8.          4.
                       (INCHES)    2.515       2.515       2.515       2.515
                        (AC-FT)     51.         51.         51.         51.

                       CUMULATIVE AREA =     .38 SQ MI


     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION     MD-1
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                    TRANSPOSITION AREA        .5 SQ MI

     TOTAL RAINFALL =    4.13, TOTAL LOSS =    1.63, TOTAL EXCESS =    2.50

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1346.      4.08                101.         25.          8.           4.
                         (INCHES)   2.492       2.492       2.492        2.492
                         (AC-FT)     50.         50.         50.          50.

                         CUMULATIVE AREA =     .38 SQ MI

       ***             ***            ***            ***            ***


                         INTERPOLATED HYDROGRAPH AT     MD-1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1346.      4.08                101.         25.          8.           4.
                         (INCHES)   2.494       2.494       2.494        2.494
                         (AC-FT)     50.         50.         50.          50.

                         CUMULATIVE AREA =     .38 SQ MI

1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION        STATION   FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                      6-HOUR      24-HOUR     72-HOUR

        HYDROGRAPH AT
+                          MD-1    1346.   4.08         101.         25.          8.        .38


 *** NORMAL END OF HEC-1 ***
```

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   12JAN04  TIME  13:29:50  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX         XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT
STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   McMicken Dam FRZR Task 3
            2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
            3           ID
            4           ID   Stantec Consulting Inc.
            5           ID   Proj No. 82000257
            6           ID   File:  Pr500-24.ih1
            7           ID   Date:  11/13/03      dln
            8           ID   Rev:
            9           ID
           10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
           11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
           12           ID   reduce impacts of flooding downstream due to the drainage area no longer
           13           ID   contributing to McMicken Dam.  Severa design events are investigated for the
           14           ID   IDF.  This model is for the 500-year, 24-hour storm.
           15           ID
           16           ID   Rainfall:  500-year, 24-hour point rainfall = 5.21 inches
           17           ID   Rainfall Losses:  Green and Ampt Rainfall Losses
           18           ID   Unit Hydrograph:  Desert/Rangeland S-Graph
           19           ID
           20           IT       5                    2000
           21           IO       3
           22           IN      15
                        *
                        *DIAGRAM
                        *
           23           JD    5.21    0.01
           24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
           25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
           26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
           27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
           28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
           29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
           30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
           31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
           32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
           33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
           34           JD   5.197     0.5
                        *

           35           KK    MD-1   BASIN
           36           KM   Subbasin     MD-1
           37           KM
           38           KM      The Desert/Rangeland S-Graph is used for this basin.
           39           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
```

```
            40          KM        Lag =  13.3 min
            41          KM
            42          BA   0.377
            43          LG    0.15    0.38    5.62    0.18       0
            44          UI     193     712     895     551     286     142      75      28      24       0
            45          UI       0       0       0       0       0       0       0       0       0       0
            46          UI       0       0       0       0       0       0       0       0       0       0
                        *
            47          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    35        MD-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS        *
 *              JUN   1998               *                    *   HYDROLOGIC ENGINEERING CENTER       *
 *           VERSION 4.1                 *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   12JAN04  TIME  13:29:50   *                    *          (916) 756-1104               *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

McMicken Dam FRZR Task 3
For the Flood Control District of Maricopa County, FCD 2002C011

Stantec Consulting Inc.
Proj No. 82000257
File: Pr500-24.ih1
Date: 11/13/03 dln
Rev:

A new dam extension is to be constructed approximately at station 75+00. The remnant section of McMicken Dam is to be modified/breached as needed to reduce impacts of flooding downstream due to the drainage area no longer contributing to McMicken Dam. Severa design events are investigated for the IDF. This model is for the 500-year, 24-hour storm.

Rainfall: 500-year, 24-hour point rainfall = 5.21 inches
Rainfall Losses: Green and Ampt Rainfall Losses
Unit Hydrograph: Desert/Rangeland S-Graph

```
  21 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

  22 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE      1    0  STARTING DATE
                      JXTIME           0  STARTING TIME

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      7    0  ENDING DATE
                      NDTIME        2235  ENDING TIME
                       ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

```
23 JD          INDEX STORM NO. 1
                    STRM        5.21  PRECIPITATION DEPTH
                    TRDA         .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

34 JD          INDEX STORM NO. 2
                    STRM        5.20  PRECIPITATION DEPTH
                    TRDA         .50  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
35 KK         *    MD-1    *        BASIN
              *            *
```

```
**************
                    Subbasin     MD-1

                      The Desert/Rangeland S-Graph is used for this basin.
                        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                        Lag =  13.3 min


            SUBBASIN RUNOFF DATA

  42 BA        SUBBASIN CHARACTERISTICS
                    TAREA          .38  SUBBASIN AREA

  43 LG        GREEN AND AMPT LOSS RATE
                    STRTL          .15  STARTING LOSS
                      DTH          .38  MOISTURE DEFICIT
                     PSIF         5.62  WETTING FRONT SUCTION
                    XKSAT          .18  HYDRAULIC CONDUCTIVITY
                    RTIMP          .00  PERCENT IMPERVIOUS AREA

  36 UI        INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                 193.0     712.0     895.0     551.0     286.0     142.0      75.0      28.0      24.0
                                                                   ***

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     MD-1
                  TRANSPOSITION AREA       .0 SQ MI

    TOTAL RAINFALL =    5.21, TOTAL LOSS =    3.25, TOTAL EXCESS =    1.96

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1035.     12.08                 79.         20.          7.          3.
                        (INCHES)    1.948       1.948       1.948       1.948
                         (AC-FT)     39.         39.         39.         39.

                       CUMULATIVE AREA =     .38 SQ MI

     ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION     MD-1
                  TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    5.20, TOTAL LOSS =    3.25, TOTAL EXCESS =    1.95

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1032.     12.08                 79.         20.          7.          3.
                        (INCHES)    1.941       1.941       1.941       1.941
                         (AC-FT)     39.         39.         39.         39.

                       CUMULATIVE AREA =     .38 SQ MI

     ***          ***          ***          ***          ***


                       INTERPOLATED HYDROGRAPH AT     MD-1

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    1032.     12.08                 79.         20.          7.          3.
                        (INCHES)    1.942       1.942       1.942       1.942
                         (AC-FT)     39.         39.         39.         39.

                       CUMULATIVE AREA =     .38 SQ MI

1
                                                RUNOFF SUMMARY
                                        FLOW IN CUBIC FEET PER SECOND
                                     TIME IN HOURS,  AREA IN SQUARE MILES
```

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	MD-1	1032.	12.08	79.	20.	7.	.38		

*** NORMAL END OF HEC-1 ***

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   12JAN04  TIME  13:30:02  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT
STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                          PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   McMicken Dam FRZR Task 3
  2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
  3           ID
  4           ID   Stantec Consulting Inc.
  5           ID   Proj No. 82000257
  6           ID   File:  PrPMF-6.ih1
  7           ID   Date:  11/11/03      dln
  8           ID   Rev:
  9           ID
 10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
 11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
 12           ID   reduce impacts of flooding downstream due to the drainage area no longer
 13           ID   contributing to McMicken Dam.  Severa design events are investigated for the
 14           ID   IDF.  This model is for the 6-hour Propable Maximum Flood.
 15           ID
 16           ID   Rainfall:  6-hr local storm PMP per the procedures in HMR-49
 17           ID   Rainfall Distribution:  From HMR-5
 18           ID   Rainfall Loses:  Green and Ampt Rainfall Losses
 19           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graphs
 20           ID
 21           IT       5                    2000
 22           IO       3
 23           IN      15
              *

 24           KK    MD-1   BASIN
 25           KM   Subbasin     MD-1
 26           KM
 27           KM      The Desert/Rangeland S-Graph is used for this basin.
 28           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
 29           KM        Lag =  13.3 min
 30           KM
 31           BA   0.377
 32           PB   12.65
 33           PI   0.110   0.110   0.110   0.110   0.179   0.179   0.179   0.179   6.212   1.771
 34           PI   0.866   0.581   0.347   0.347   0.347   0.347   0.108   0.108   0.108   0.108
 35           PI   0.061   0.061   0.061   0.061
 36           LG    0.15    0.38    5.62    0.18       0
 37           UI     193     712     895     551     286     142      75      28      24       0
 38           UI       0       0       0       0       0       0       0       0       0       0
 39           UI       0       0       0       0       0       0       0       0       0       0
              *

 40           KK   MD-2A   BASIN
```

```
          41          KM   Subbasin     MD-2A
          42          KM
          43          KM      The Mountain S-Graph is used for this basin.
          44          KM        L = 4.595  Lca = 2.876  S = 417.88 ft/mi  Kn = 0.050
          45          KM        Lag =  61.0 min
          46          KM
          47          BA   3.593
          48          LG    0.25    0.35    3.99    0.40      20
          49          UI     197     200     269     611     840    1134    1302    1475    1634    1993
          50          UI    2385    1586    1324    1202    1111    1006     946     857     791     711
          51          UI     626     534     493     462     435     408     323     293     256     244
1                                                HEC-1 INPUT                                          PAGE  2

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          52          UI     217     219     173     151     154     150      97      98      96      97
          53          UI      98      80      38      39      37      38      39      37      38      38
          54          UI      38       0       0       0       0       0       0       0       0       0
          55          UI       0       0       0       0       0       0       0       0       0       0
                      *

          56          KK   MD-2B   BASIN
          57          KM   Subbasin     MD-2B
          58          KM
          59          KM      The Mountain S-Graph is used for this basin.
          60          KM        L = 2.437 mi.   Lca = 1.290 mi.   S = 574.5 ft/mi   Kn = 0.050
          61          KM        Lag =  33.3 min
          62          KM
          63          BA   0.866
          64          LG    0.25    0.35    4.08    0.38      19
          65          UI      88     168     397     578     729     981     640     525     444     383
          66          UI     321     248     209     193     141     113      99      81      68      55
          67          UI      43      43      32      17      17      17      17      17      17      17
          68          UI       0       0       0       0       0       0       0       0       0       0
          69          UI       0       0       0       0       0       0       0       0       0       0
                      *

          70          KK       1   BASIN
          71          KM   Subbasin     1
          72          KM
          73          KM      The Mountain S-Graph is used for this basin.
          74          KM        L = 3.40 mi.   Lca = 1.36 mi.   S = 505.5 ft/mi   Kn = 0.050
          75          KM        Lag =  39 min
          76          KM
          77          BA   1.940
          78          LG    0.20    0.35    4.00    0.52      10
          79          UI     166     232     588     934    1190    1417    1903    1314    1016     915
          80          UI     804     692     591     487     408     373     319     251     213     186
          81          UI     165     127     129      83      82      83      65      32      33      32
          82          UI      31      33      32      32      32      32       0       0       0       0
          83          UI       0       0       0       0       0       0       0       0       0       0
                      *
          84          ZZ
1*************************************                    *************************************
*                                   *                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS    *
*              JUN  1998            *                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.1             *                    *         609 SECOND STREET         *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
* RUN DATE   12JAN04  TIME  13:30:02 *                    *         (916) 756-1104            *
*                                   *                    *                                   *
*************************************                    *************************************
```

McMicken Dam FRZR Task 3
For the Flood Control District of Maricopa County, FCD 2002C011

Stantec Consulting Inc.
Proj No. 82000257
File: PrPMF-6.ih1
Date: 11/11/03 dln
Rev:

A new dam extension is to be constructed approximately at station 75+00. The remnant section of McMicken Dam is to be modified/breached as needed to reduce impacts of flooding downstream due to the drainage area no longer contributing to McMicken Dam. Severa design events are investigated for the IDF. This model is for the 6-hour Propable Maximum Flood.

Rainfall: 6-hr local storm PMP per the procedures in HMR-49

```
                    Rainfall Distribution:  From HMR-5
                    Rainfall Loses:  Green and Ampt Rainfall Losses
                    Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graphs

 22 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     7    0  ENDING DATE
                     NDTIME       2235  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***

            **************
            *            *
 24 KK      *      MD-1  *        BASIN
            *            *
            **************
                           Subbasin     MD-1

                              The Desert/Rangeland S-Graph is used for this basin.
                                L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                                Lag =  13.3 min

 23 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE     1    0  STARTING DATE
                      JXTIME          0  STARTING TIME

              SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                       TAREA        .38  SUBBASIN AREA

                PRECIPITATION DATA

 32 PB                STORM      12.65  BASIN TOTAL PRECIPITATION

 33 PI            INCREMENTAL PRECIPITATION PATTERN
                     .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                     .04       .04       .06       .06       .06       .06       .06       .06       .06       .06
                     .06       .06       .06       .06      2.07      2.07      2.07       .59       .59       .59
                     .29       .29       .29       .19       .19       .19       .12       .12       .12       .12
                     .12       .12       .12       .12       .12       .12       .12       .12       .04       .04
                     .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                     .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                     .02       .02

 36 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .15  STARTING LOSS
                        DTH        .38  MOISTURE DEFICIT
                       PSIF       5.62  WETTING FRONT SUCTION
                      XKSAT        .18  HYDRAULIC CONDUCTIVITY
                      RTIMP        .00  PERCENT IMPERVIOUS AREA

 36 UI          INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
```

```
                    193.0     712.0     895.0     551.0     286.0     142.0      75.0      28.0      24.0
                                                                  ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION     MD-1

    TOTAL RAINFALL =   12.65, TOTAL LOSS =    2.64, TOTAL EXCESS =   10.01

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    4481.      2.33                404.        101.         34.         15.
                         (INCHES)   9.963       9.963       9.963       9.963
                          (AC-FT)   200.        200.        200.        200.

                        CUMULATIVE AREA =     .38 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***

            **************
            *            *
  40 KK     *     MD-2A  *        BASIN
            *            *
            **************
                          Subbasin     MD-2A

                            The Mountain S-Graph is used for this basin.
                              L = 4.595  Lca = 2.876  S = 417.88 ft/mi  Kn = 0.050
                              Lag =  61.0 min


              SUBBASIN RUNOFF DATA

  47 BA          SUBBASIN CHARACTERISTICS
                      TAREA        3.59  SUBBASIN AREA

                 PRECIPITATION DATA

  32 PB               STORM       12.65  BASIN TOTAL PRECIPITATION

  33 PI            INCREMENTAL PRECIPITATION PATTERN
                      .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                      .04       .04       .06       .06       .06       .06       .06       .06       .06       .06
                      .06       .06       .06       .06      2.07      2.07      2.07       .59       .59       .59
                      .29       .29       .29       .19       .19       .19       .12       .12       .12       .12
                      .12       .12       .12       .12       .12       .12       .12       .12       .04       .04
                      .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                      .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                      .02       .02

  48 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .25  STARTING LOSS
                        DTH        .35  MOISTURE DEFICIT
                       PSIF       3.99  WETTING FRONT SUCTION
                      XKSAT        .40  HYDRAULIC CONDUCTIVITY
                      RTIMP      20.00  PERCENT IMPERVIOUS AREA

  41 UI          INPUT UNITGRAPH,  51 ORDINATES,  VOLUME =  .99
                    197.0     200.0     269.0     611.0     840.0    1134.0    1302.0    1475.0    1634.0    1993.0
                   2385.0    1586.0    1324.0    1202.0    1111.0    1006.0     946.0     857.0     791.0     711.0
                    626.0     534.0     493.0     462.0     435.0     408.0     323.0     293.0     256.0     244.0
                    217.0     219.0     173.0     151.0     154.0     150.0      97.0      98.0      96.0      97.0
                     98.0      80.0      38.0      39.0      37.0      38.0      39.0      37.0      38.0      38.0
                     38.0
                                                                  ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    MD-2A

    TOTAL RAINFALL =   12.65, TOTAL LOSS =    2.67, TOTAL EXCESS =    9.98
```

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+   15177.      3.00                3811.       957.        319.        138.
                         (INCHES)    9.862      9.910       9.910       9.910
                          (AC-FT)    1890.      1899.       1899.       1899.

                         CUMULATIVE AREA =    3.59 SQ MI


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** ***

            **************
            *            *
  56 KK     *     MD-2B  *        BASIN
            *            *
            **************
                           Subbasin     MD-2B

                              The Mountain S-Graph is used for this basin.
                                L = 2.437 mi.   Lca = 1.290 mi.   S = 574.5 ft/mi   Kn = 0.050
                                Lag =  33.3 min


              SUBBASIN RUNOFF DATA

  63 BA         SUBBASIN CHARACTERISTICS
                      TAREA          .87  SUBBASIN AREA

                PRECIPITATION DATA

  32 PB               STORM       12.65  BASIN TOTAL PRECIPITATION

  33 PI           INCREMENTAL PRECIPITATION PATTERN
                     .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                     .04       .04       .06       .06       .06       .06       .06       .06       .06       .06
                     .06       .06       .06       .06      2.07      2.07      2.07       .59       .59       .59
                     .29       .29       .29       .19       .19       .19       .12       .12       .12       .12
                     .12       .12       .12       .12       .12       .12       .12       .12       .04       .04
                     .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                     .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                     .02       .02

  64 LG         GREEN AND AMPT LOSS RATE
                      STRTL         .25  STARTING LOSS
                        DTH         .35  MOISTURE DEFICIT
                       PSIF        4.08  WETTING FRONT SUCTION
                      XKSAT         .38  HYDRAULIC CONDUCTIVITY
                      RTIMP       19.00  PERCENT IMPERVIOUS AREA

  57 UI         INPUT UNITGRAPH,  30 ORDINATES,  VOLUME = 1.00
                    88.0      168.0     397.0     578.0     729.0     981.0     640.0     525.0     444.0     383.0
                   321.0      248.0     209.0     193.0     141.0     113.0      99.0      81.0      68.0      55.0
                    43.0       43.0      32.0      17.0      17.0      17.0      17.0      17.0      17.0      17.0

                                                                   ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    MD-2B

    TOTAL RAINFALL =   12.65, TOTAL LOSS =    2.66, TOTAL EXCESS =    9.99

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    5387.      2.58                 928.       232.         77.          33.
                         (INCHES)    9.962      9.979       9.979       9.979
                          (AC-FT)    460.       461.        461.        461.

                         CUMULATIVE AREA =     .87 SQ MI
```

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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   70 KK      *          1 *        BASIN
              *            *
              **************
                                Subbasin     1

                                  The Mountain S-Graph is used for this basin.
                                    L = 3.40 mi.   Lca = 1.36 mi.   S = 505.5 ft/mi   Kn = 0.050
                                    Lag =  39 min

                 SUBBASIN RUNOFF DATA

   77 BA           SUBBASIN CHARACTERISTICS
                        TAREA        1.94  SUBBASIN AREA

                   PRECIPITATION DATA

   32 PB                STORM       12.65  BASIN TOTAL PRECIPITATION

   33 PI             INCREMENTAL PRECIPITATION PATTERN
                        .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                        .04       .04       .06       .06       .06       .06       .06       .06       .06       .06
                        .06       .06       .06       .06      2.07      2.07      2.07       .59       .59       .59
                        .29       .29       .29       .19       .19       .19       .12       .12       .12       .12
                        .12       .12       .12       .12       .12       .12       .12       .12       .04       .04
                        .04       .04       .04       .04       .04       .04       .04       .04       .04       .04
                        .02       .02       .02       .02       .02       .02       .02       .02       .02       .02
                        .02       .02

   78 LG           GREEN AND AMPT LOSS RATE
                        STRTL        .20  STARTING LOSS
                          DTH        .35  MOISTURE DEFICIT
                         PSIF       4.00  WETTING FRONT SUCTION
                        XKSAT        .52  HYDRAULIC CONDUCTIVITY
                        RTIMP      10.00  PERCENT IMPERVIOUS AREA

   71 UI           INPUT UNITGRAPH,  36 ORDINATES,  VOLUME = 1.00
                       166.0     232.0     588.0     934.0    1190.0    1417.0    1903.0    1314.0    1016.0     915.0
                       804.0     692.0     591.0     487.0     408.0     373.0     319.0     251.0     213.0     186.0
                       165.0     127.0     129.0      83.0      82.0      83.0      65.0      32.0      33.0      32.0
                        31.0      33.0      32.0      32.0      32.0      32.0
                                                                   ***

      ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION        1

    TOTAL RAINFALL =   12.65, TOTAL LOSS =    3.32, TOTAL EXCESS =    9.33

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+   10698.      2.67                 1945.        487.        162.         70.
                          (INCHES)   9.321       9.334       9.334       9.334
                           (AC-FT)    964.        966.        966.        966.

                         CUMULATIVE AREA =    1.94 SQ MI

1
                                                RUNOFF SUMMARY
                                        FLOW IN CUBIC FEET PER SECOND
                                      TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM    TIME OF
          OPERATION       STATION    FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                           MD-1     4481.   2.33          404.        101.         34.       .38

          HYDROGRAPH AT
+                          MD-2A    15177.   3.00         3811.        957.        319.      3.59
```

```
          HYDROGRAPH AT
+                         MD-2B      5387.    2.58        928.        232.        77.        .87

          HYDROGRAPH AT
+                              1     10698.    2.67       1945.        487.       162.       1.94


 *** NORMAL END OF HEC-1 ***
```

```
1*************************************                    *************************************
 *                                   *                    *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS    *
 *              JUN   1998           *                    *   HYDROLOGIC ENGINEERING CENTER   *
 *            VERSION 4.1            *                    *         609 SECOND STREET         *
 *                                   *                    *      DAVIS, CALIFORNIA 95616      *
 * RUN DATE   12JAN04  TIME  13:30:15  *                    *          (916) 756-1104           *
 *                                   *                    *                                   *
 *************************************                    *************************************

                                        X     X  XXXXXXX   XXXXX          X
                                        X     X  X        X     X        XX
                                        X     X  X        X              X
                                        XXXXXXX  XXXX     X        XXXXX X
                                        X     X  X        X              X
                                        X     X  X        X     X        X
                                        X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   McMicken Dam FRZR Task 3
  2           ID   For the Flood Control District of Maricopa County, FCD 2002C011
  3           ID
  4           ID   Stantec Consulting Inc.
  5           ID   Proj No. 82000257
  6           ID   File:  PrPMF-72.ih1
  7           ID   Date:  11/11/03 dln
  8           ID   Rev:
  9           ID
 10           ID   A new dam extension is to be constructed approximately at station 75+00.  The
 11           ID   remnant section of McMicken Dam is to be modified/breached as needed to
 12           ID   reduce impacts of flooding downstream due to the drainage area no longer
 13           ID   contributing to McMicken Dam.  Severa design events are investigated for the
 14           ID   IDF.  This model is for the 72-hour storm Probable Maximum Storm
 15           ID
 16           ID   Rainfall: 72-hr general storm PMP per the procedures in HMR-49
 17           ID   Rainfall Distribution:  From HMR-36
 18           ID   Rainfall Loses:  Green and Ampt Rainfall Losses
 19           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graphs
 20           ID
 21           IT       5                    2000
 22           IO       3
 23           IN     360
              *

 24           KK    MD-1   BASIN
 25           KM   Subbasin     MD-1
 26           KM
 27           KM      The Desert/Rangeland S-Graph is used for this basin.
 28           KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
 29           KM        Lag =  13.3 min
 30           KM
 31           BA   0.377
 32           PB   17.92
 33           PI   0.150   0.200   0.478   0.650   0.896   2.368   9.867   1.372   0.698   0.650
 34           PI   0.372   0.225
 35           LG    0.15    0.38    5.62    0.18       0
 36           UI     193     712     895     551     286     142      75      28      24       0
 37           UI       0       0       0       0       0       0       0       0       0       0
 38           UI       0       0       0       0       0       0       0       0       0       0
              *

 39           KK   MD-2A   BASIN
 40           KM   Subbasin     MD-2A
```

```
          41          KM
          42          KM      The Mountain S-Graph is used for this basin.
          43          KM        L = 4.595  Lca = 2.876  S = 304.7 ft/mi  Kn = 0.050
          44          KM        Lag =  64.8 min
          45          KM
          46          BA   3.593
          47          LG    0.25    0.35    3.99    0.40      20
          48          UI     185     188     189     532     740     975    1148    1330    1428    1654
          49          UI    2072    2061    1410    1221    1096    1045     956     886     813     764
          50          UI     682     606     539     476     448     429     392     353     310     262
          51          UI     237     230     202     203     172     142     142     143     109      91
1                                                HEC-1 INPUT                                                PAGE  2

        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          52          UI      92      91      90      92      61      36      36      35      36      36
          53          UI      35       0       0       0       0       0       0       0       0       0
          54          UI       0       0       0       0       0       0       0       0       0       0
          55          UI       0       0       0       0       0       0       0       0       0       0
                      *

          56          KK   MD-2B   BASIN
          57          KM   Subbasin     MD-2B
          58          KM
          59          KM      The Mountain S-Graph is used for this basin.
          60          KM        L = 2.437 mi.   Lca = 1.290 mi.   S = 574.5 ft/mi   Kn = 0.050
          61          KM        Lag =  33.3 min
          62          KM
          63          BA   0.866
          64          LG    0.25    0.35    4.08    0.38      19
          65          UI      88     168     397     578     729     981     640     525     444     383
          66          UI     321     248     209     193     141     113      99      81      68      55
          67          UI      43      43      32      17      17      17      17      17      17      17
          68          UI       0       0       0       0       0       0       0       0       0       0
          69          UI       0       0       0       0       0       0       0       0       0       0
                      *

          70          KK       1   BASIN
          71          KM   Subbasin     1
          72          KM
          73          KM      The Mountain S-Graph is used for this basin.
          74          KM        L = 3.40 mi.   Lca = 1.36 mi.   S = 505.5 ft/mi   Kn = 0.050
          75          KM        Lag =  39 min
          76          KM
          77          BA   1.940
          78          LG    0.20    0.35    4.00    0.52      10
          79          UI     166     232     588     934    1190    1417    1903    1314    1016     915
          80          UI     804     692     591     487     408     373     319     251     213     186
          81          UI     165     127     129      83      82      83      65      32      33      32
          82          UI      31      33      32      32      32      32       0       0       0       0
          83          UI       0       0       0       0       0       0       0       0       0       0
                      *
          84          ZZ
1*************************************                    *************************************
*                                   *                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                *   U.S. ARMY CORPS OF ENGINEERS    *
*              JUN   1998           *                    *   HYDROLOGIC ENGINEERING CENTER   *
*            VERSION 4.1            *                    *          609 SECOND STREET        *
*                                   *                    *       DAVIS, CALIFORNIA 95616     *
*  RUN DATE   12JAN04  TIME  13:30:15  *                 *          (916) 756-1104           *
*                                   *                    *                                   *
*************************************                    *************************************
```

McMicken Dam FRZR Task 3
For the Flood Control District of Maricopa County, FCD 2002C011

Stantec Consulting Inc.
Proj No. 82000257
File: PrPMF-72.ih1
Date: 11/11/03 dln
Rev:

A new dam extension is to be constructed approximately at station 75+00. The remnant section of McMicken Dam is to be modified/breached as needed to reduce impacts of flooding downstream due to the drainage area no longer contributing to McMicken Dam. Severa design events are investigated for the IDF. This model is for the 72-hour storm Probable Maximum Storm

Rainfall: 72-hr general storm PMP per the procedures in HMR-49

```
                    Rainfall Distribution:  From HMR-36
                    Rainfall Loses:  Green and Ampt Rainfall Losses
                    Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graphs

 22 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      7   0  ENDING DATE
                     NDTIME       2235  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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            *            *
 24 KK      *     MD-1   *        BASIN
            *            *
            **************
                       Subbasin     MD-1

                         The Desert/Rangeland S-Graph is used for this basin.
                           L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
                           Lag =  13.3 min


 23 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN        360  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
                     JXTIME          0  STARTING TIME

               SUBBASIN RUNOFF DATA

 31 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .38  SUBBASIN AREA

               PRECIPITATION DATA

 32 PB                STORM      17.92  BASIN TOTAL PRECIPITATION

 33 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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35 LG        GREEN AND AMPT LOSS RATE
                STRTL        .15  STARTING LOSS
                  DTH        .38  MOISTURE DEFICIT
                 PSIF       5.62  WETTING FRONT SUCTION
                XKSAT        .18  HYDRAULIC CONDUCTIVITY
                RTIMP        .00  PERCENT IMPERVIOUS AREA

35 UI        INPUT UNITGRAPH,   9 ORDINATES,  VOLUME = 1.00
                 193.0    712.0    895.0    551.0    286.0    142.0     75.0     28.0     24.0
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                          HYDROGRAPH AT STATION     MD-1

    TOTAL RAINFALL =   17.92, TOTAL LOSS =    9.08, TOTAL EXCESS =    8.84

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                          6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     338.     42.00                     330.         89.         30.          13.
                          (INCHES)     8.129       8.802       8.802        8.802
                           (AC-FT)       163.        177.        177.         177.

                          CUMULATIVE AREA =     .38 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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            **************
            *            *
  39 KK     *     MD-2A  *        BASIN
            *            *
            **************
                          Subbasin     MD-2A

                            The Mountain S-Graph is used for this basin.
                              L = 4.595  Lca = 2.876  S = 304.7 ft/mi  Kn = 0.050
                              Lag =  64.8 min


            SUBBASIN RUNOFF DATA

  46 BA       SUBBASIN CHARACTERISTICS
                 TAREA        3.59  SUBBASIN AREA

              PRECIPITATION DATA

  32 PB          STORM       17.92  BASIN TOTAL PRECIPITATION

  33 PI        INCREMENTAL PRECIPITATION PATTERN
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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.00	.00	.00	.00						

47 LG GREEN AND AMPT LOSS RATE

STRTL	.25	STARTING LOSS
DTH	.35	MOISTURE DEFICIT
PSIF	3.99	WETTING FRONT SUCTION
XKSAT	.40	HYDRAULIC CONDUCTIVITY
RTIMP	20.00	PERCENT IMPERVIOUS AREA

40 UI INPUT UNITGRAPH, 51 ORDINATES, VOLUME = .99

185.0	188.0	189.0	532.0	740.0	975.0	1148.0	1330.0	1428.0	1654.0
2072.0	2061.0	1410.0	1221.0	1096.0	1045.0	956.0	886.0	813.0	764.0
682.0	606.0	539.0	476.0	448.0	429.0	392.0	353.0	310.0	262.0
237.0	230.0	202.0	203.0	172.0	142.0	142.0	143.0	109.0	91.0
92.0	91.0	90.0	92.0	61.0	36.0	36.0	35.0	36.0	36.0
35.0									

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HYDROGRAPH AT STATION MD-2A

TOTAL RAINFALL = 17.92, TOTAL LOSS = 8.82, TOTAL EXCESS = 9.10

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW		
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			

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+    2884.     42.00                 2602.        803.        289.        125.
                          (INCHES)    6.733       8.309       8.989       8.993
                           (AC-FT)    1290.       1592.       1723.       1723.

                          CUMULATIVE AREA =    3.59 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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              **************
              *            *
  56 KK       *    MD-2B   *        BASIN
              *            *
              **************
                                Subbasin     MD-2B

                                  The Mountain S-Graph is used for this basin.
                                    L = 2.437 mi.   Lca = 1.290 mi.   S = 574.5 ft/mi   Kn = 0.050
                                    Lag =  33.3 min


                SUBBASIN RUNOFF DATA

  63 BA           SUBBASIN CHARACTERISTICS
                       TAREA          .87  SUBBASIN AREA

                  PRECIPITATION DATA

  32 PB                STORM        17.92  BASIN TOTAL PRECIPITATION

  33 PI             INCREMENTAL PRECIPITATION PATTERN
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                       .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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64 LG          GREEN AND AMPT LOSS RATE
                     STRTL        .25  STARTING LOSS
                       DTH        .35  MOISTURE DEFICIT
                      PSIF       4.08  WETTING FRONT SUCTION
                     XKSAT        .38  HYDRAULIC CONDUCTIVITY
                     RTIMP      19.00  PERCENT IMPERVIOUS AREA

57 UI          INPUT UNITGRAPH,  30 ORDINATES,  VOLUME = 1.00
                   88.0     168.0     397.0     578.0     729.0     981.0     640.0     525.0     444.0     383.0
                  321.0     248.0     209.0     193.0     141.0     113.0      99.0      81.0      68.0      55.0
                   43.0      43.0      32.0      17.0      17.0      17.0      17.0      17.0      17.0      17.0
                                                                  ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    MD-2B

    TOTAL RAINFALL =   17.92, TOTAL LOSS =    8.83, TOTAL EXCESS =    9.09

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    711.      42.00                669.        196.         70.         30.
                         (INCHES)   7.186       8.430       9.081       9.083
                          (AC-FT)    332.        389.        419.        420.

                        CUMULATIVE AREA =     .87 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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70 KK      *          1  *        BASIN
           *             *
           **************
                          Subbasin     1

                            The Mountain S-Graph is used for this basin.
                              L = 3.40 mi.   Lca = 1.36 mi.   S = 505.5 ft/mi   Kn = 0.050
                              Lag =  39 min


             SUBBASIN RUNOFF DATA

77 BA          SUBBASIN CHARACTERISTICS
                    TAREA        1.94  SUBBASIN AREA

               PRECIPITATION DATA

32 PB                STORM       17.92  BASIN TOTAL PRECIPITATION

33 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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 78 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .20  STARTING LOSS
                        DTH        .35  MOISTURE DEFICIT
                       PSIF       4.00  WETTING FRONT SUCTION
                      XKSAT        .52  HYDRAULIC CONDUCTIVITY
                      RTIMP      10.00  PERCENT IMPERVIOUS AREA

 71 UI          INPUT UNITGRAPH,  36 ORDINATES,  VOLUME = 1.00
                    166.0     232.0     588.0     934.0    1190.0    1417.0    1903.0    1314.0    1016.0     915.0
                    804.0     692.0     591.0     487.0     408.0     373.0     319.0     251.0     213.0     186.0
                    165.0     127.0     129.0      83.0      82.0      83.0      65.0      32.0      33.0      32.0
                     31.0      33.0      32.0      32.0      32.0      32.0
                                                                   ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION        1

    TOTAL RAINFALL =   17.92, TOTAL LOSS =   10.68, TOTAL EXCESS =    7.24

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                              (CFS)
+   1368.      42.00          1263.       359.        126.         54.
                         (INCHES)    6.051       6.891       7.235       7.236
                          (AC-FT)     626.        713.        749.        749.

                       CUMULATIVE AREA =    1.94 SQ MI

1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION      FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR
        HYDROGRAPH AT
+                         MD-1       338.   42.00         330.        89.         30.       .38
        HYDROGRAPH AT
+                         MD-2A     2884.   42.00        2602.       803.        289.      3.59
        HYDROGRAPH AT
+                         MD-2B      711.   42.00         669.       196.         70.       .87
        HYDROGRAPH AT
+                           1       1368.   42.00        1263.       359.        126.      1.94
```

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*** NORMAL END OF HEC-1 ***
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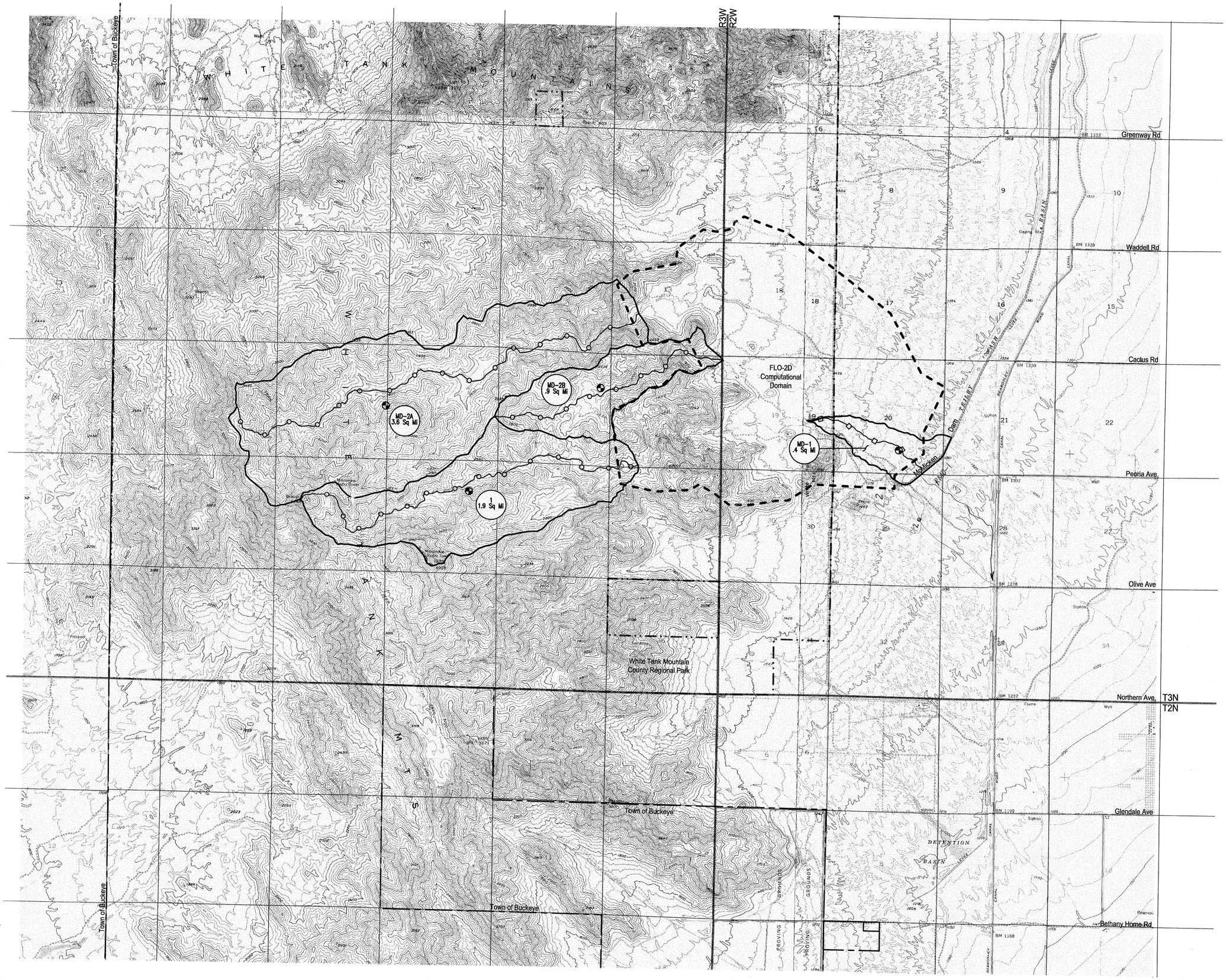
APPENDIX D

DIGITAL FILES



MARICOPA COUNTY FLOOD CONTROL DISTRICT

McMicken Dam FRZR Final Design

Maricopa County, AZ

Prepared By

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Stantec

Legend

Corporate Limits	Corporate Limits
Park Boundary	
Township/Range Line	
Basin Boundary	
Basin Identifier	MD-1 0.8 Sq. Mi.
FLO-2D Computational Area	
Basin Centroid	
Time of Concentration Flowpath	
Routing Reach	

Notes

Subbasin 1 is from the Loop 303 Corridor / White Tanks ADMP Update (2002). Flowpath lines are added based on available topo for the purpose of this exhibit and may not reflect the actual alignments.

N

File Name: wwm257.dwg

Dwn.	Chkd.	Dsgn.	MM.DD.YY
BGS			10.30.03

Title

Plate 1
Watershed Map

Project No. 82000257

Scale 1"=2000' (0, 2000', 3000', 4000')

Drawing No.

Sheet 1 of 1

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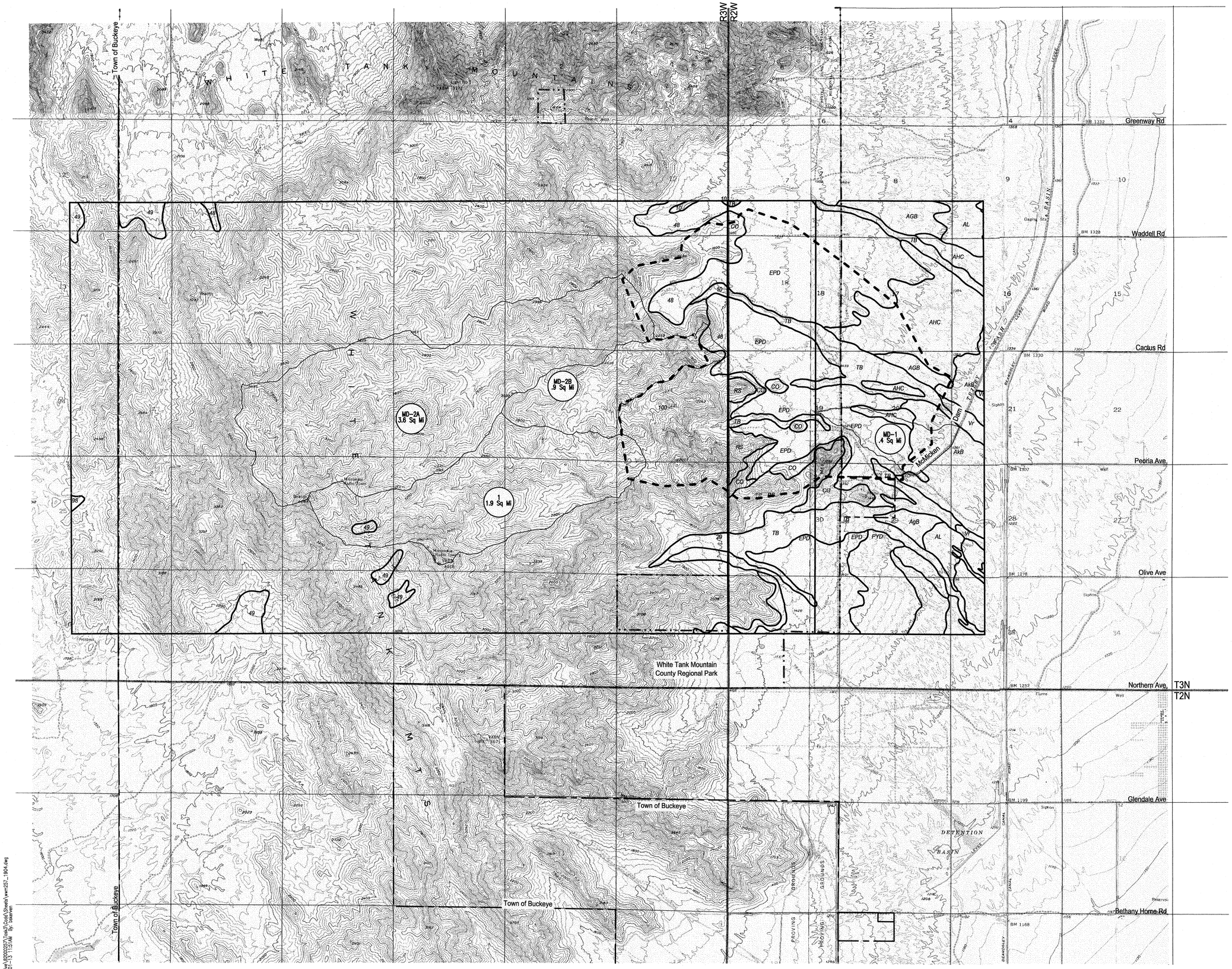

MARICOPA COUNTY
FLOOD CONTROL
DISTRICT

McMicken Dam FRZR
Final Design

Maricopa County, AZ

Prepared By

Stantec

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8211 South 48th Street
Phoenix AZ U.S.A. 85044

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Fax. 602.431.9562
www.stantec.com

Legend

Corporate Limits	Town of Buckeye
Park Boundary	
Township/Range Line	
Basin Boundary	
Basin Identifier	MD-1
Soil Boundary	
Soil Identifier	AkB
FLO-2D Computational Domain	

Notes

Soil map units within Township 3N, Range Line 3W are taken from the Aguila-Carefree Area, parts of Maricopa and Pinal Counties, Arizona Soil Survey.

Soil map units within Township 3N, Range Line 2W are taken from the Maricopa County, Arizona, Central Part Soil Survey.

N

File Name: wwm257.dwg	HAR	MCG	DLN	11.14.03
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Title

Plate 2
Soils Map

Project No.
82000257

Scale 0 2000' 3000' 4000'
1"=2000'

Drawing No.

Sheet

1 of 1

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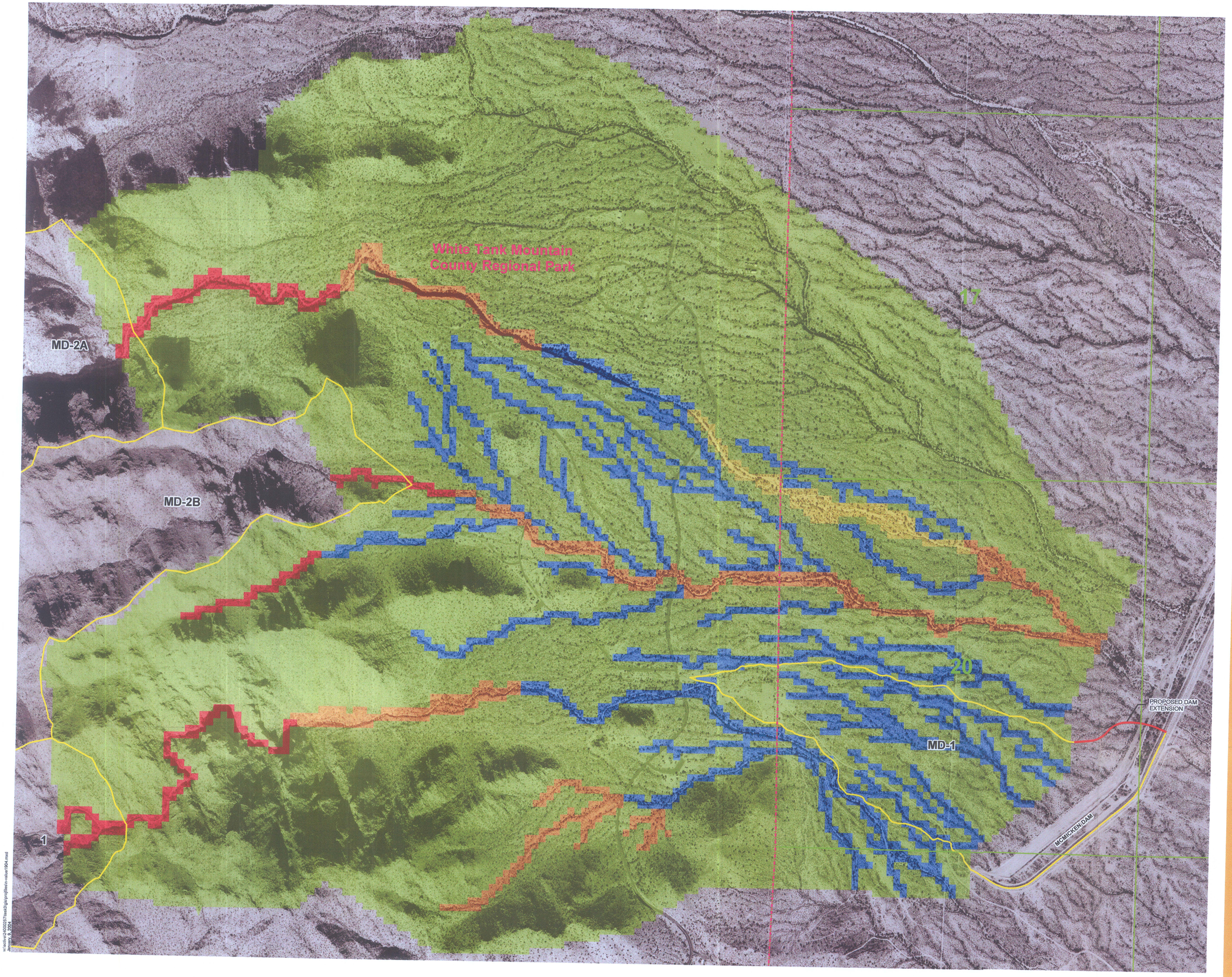

Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

MCMICKEN DAM FRZR
FINAL DESIGN

MARICOPA COUNTY, AZ

Prepared By

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Extention
- HEC-1 Subbasin Boundaries
- Park Boundary
- Section Lines

N-VALUE

- 0.035
- 0.04
- 0.05
- 0.055
- 0.06

N

File Name:	BGS	XXX	XXX	01.09.04
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Title
Plate 3
Roughness Coefficient Map

Project No.
82000257

Scale
0 250 500 1,000 1,500
Feet

Figure No.

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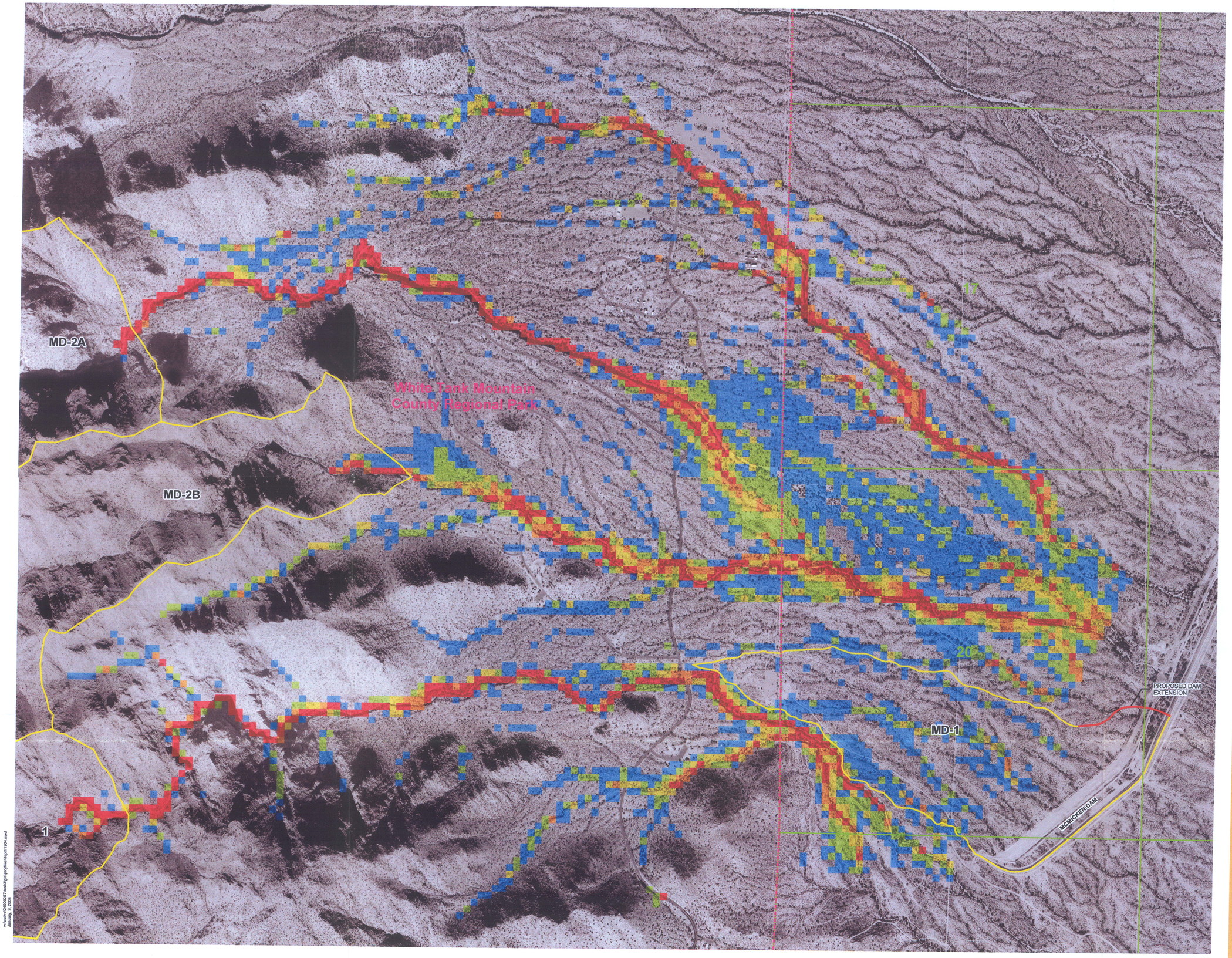
January 8, 2004



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

MCMICKEN DAM FRZR
FINAL DESIGN

MARICOPA COUNTY, AZ

Prepared By

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www.stantec.com

Legend

- Dam Extention
- HEC-1 Subbasin Boundaries
- Park Boundary
- Section Lines

Depth in Feet

- <1
- 1-2
- 2-3
- 3-4
- 4-5
- >5

N

File Name:	BGS	XXX	XXX	01.09.04
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Title
Plate 4
Inundation Map for the PMF

Project No.
82000257

Scale
Feet 0 250 500 1,000 1,500

Figure No.

w:\active\82000257\task3\gis\profiles\depth1904.mxd
January 19, 2004